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OPERATION OF MINIDOKA RECLAMATION PROJECT.

BY BARRY DIBBLE.

THE THREE TYPES OF MANAGEMENT.

BY E. ST. ELMO LEWIS.

MONTEREY GAS DECISION.

SEATTLE LIGHTING REPORT.

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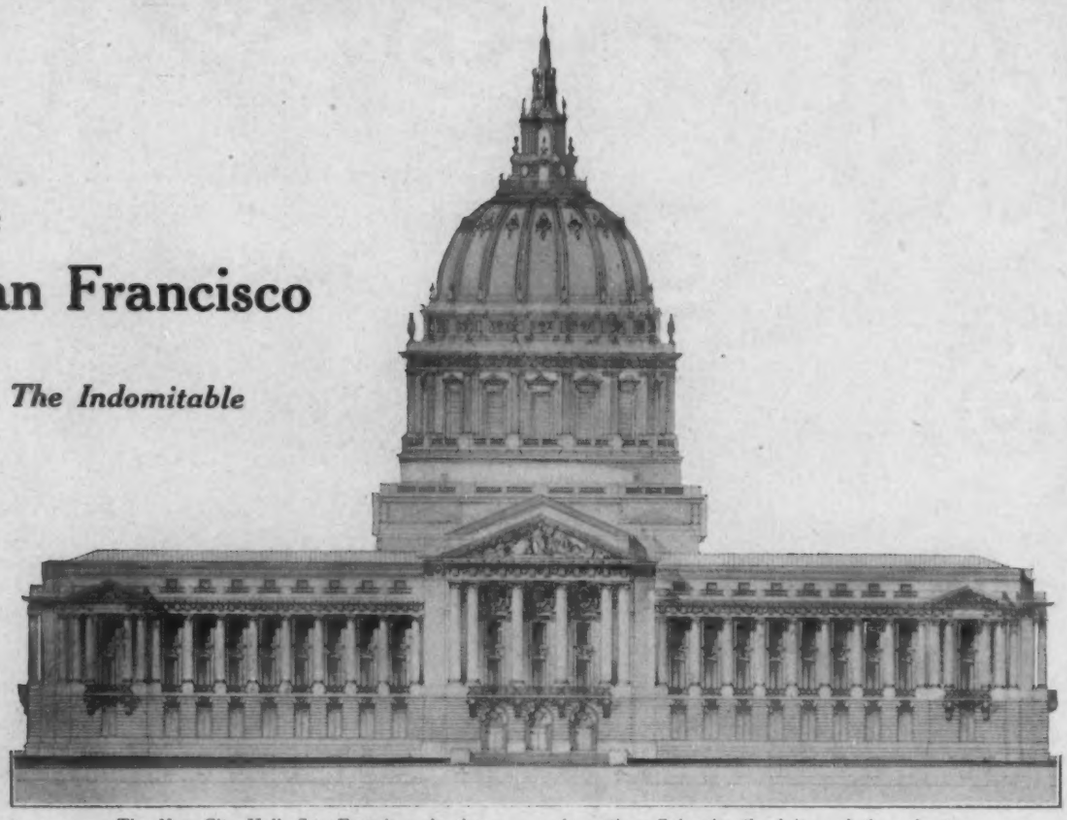

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JOURNAL OF ELECTRICITY
POWER AND GAS
Devoted to the Conversion, Transmission and Distribution of Energy

VOLUME XXXIII SAN FRANCISCO, JULY 11, 1914 NUMBER 2

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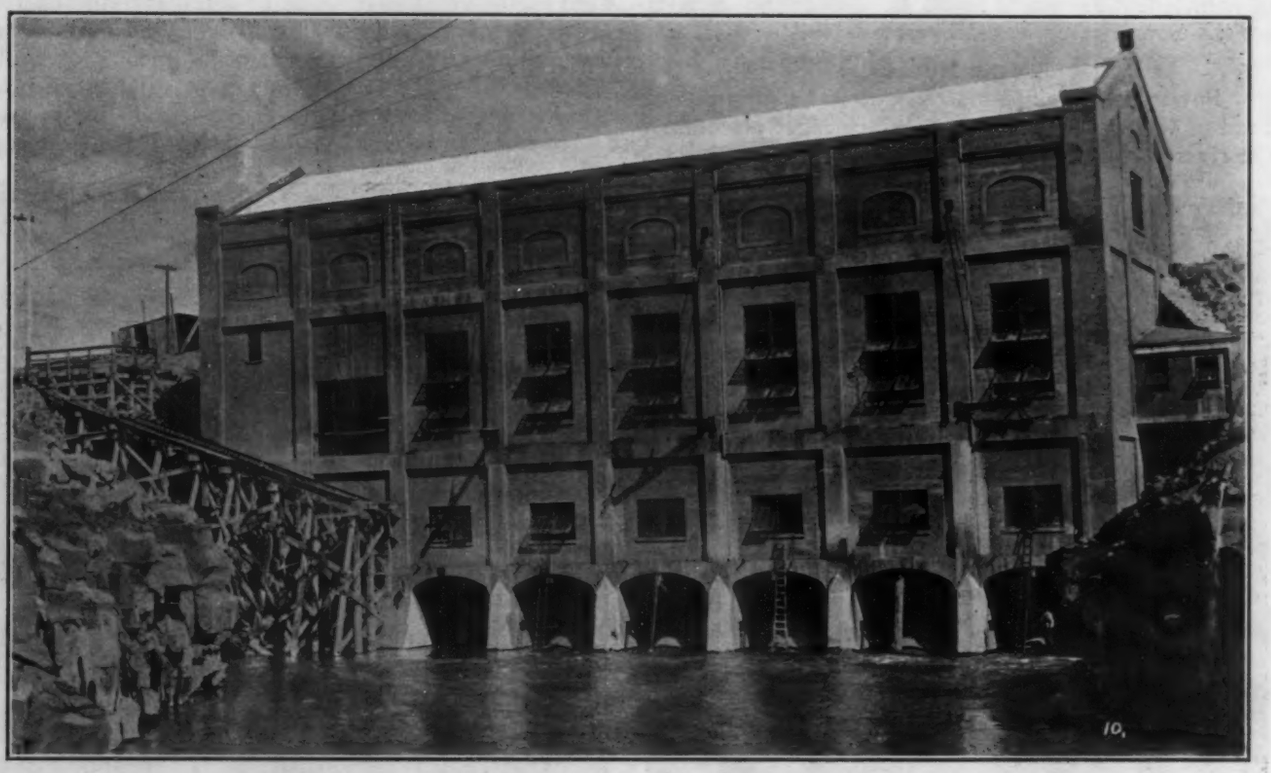
OPERATION OF MINIDOKA RECLAMATION PROJECT

BY BARRY DIBBLE.

(After a brief description of the power development, supplementing that published in these columns June 13, 1912, the author gives the details of operating results, together with description of recent extensions. Valuable data on the use of electricity for summer pumping and winter heating are included. Mr. Barry has been in charge of construction and operation of this project for the past four years. Mr. O. H. Ensign of Los Angeles, chief mechanical and electrical engineer for the Reclamation Service, was responsible for the design of the system.—The Editor.)

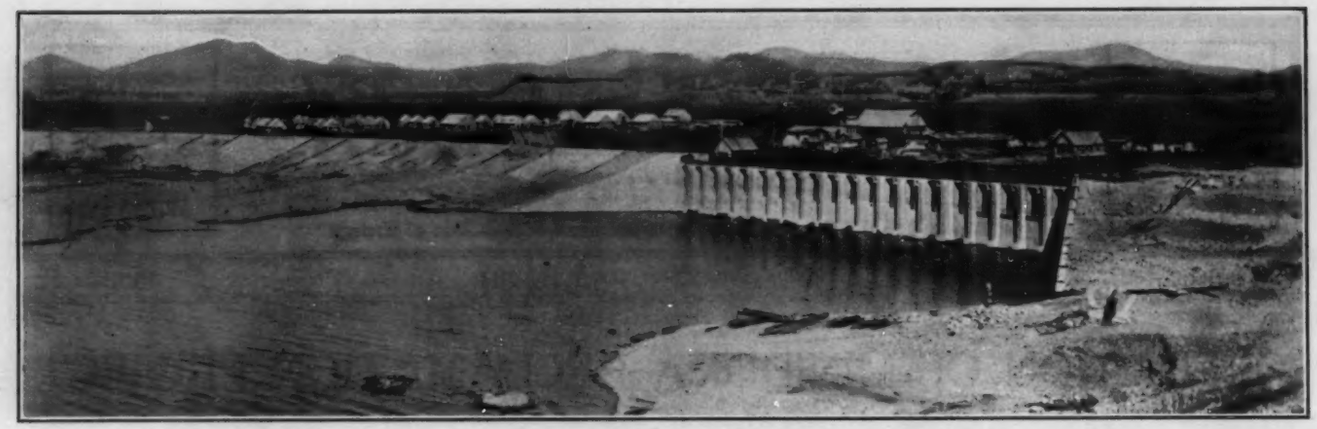


Minidoka Power House.

The Minidoka Project of the United States Reclamation Service is situated on the Snake River in Southern Idaho directly north from the north and south boundary between Utah and Nevada. It was one of the first projects begun by the Reclamation Service and is now practically completed. Water for 118,000 acres is diverted from the Snake River by a rock fill dam which has a maximum height of 86 ft. and a length of 937 ft. The spillway is a concrete structure about half a mile in length on which concrete piers have been built to hold flash-boards for storage purposes.

The drainage area above this diversion dam is 22,600 square miles. The normal flood occurs in June and usually reaches a peak of from 30,000 to 40,000 second feet. The low water stage follows soon after the flood in July and August and sometimes the river drops to 2000 second feet, although from 2500 to 3000 second feet is the usual minimum. Prior water rights below the Minidoka Dam are entitled to the normal flow of the river up to 3400 second feet. Storage has therefore been developed in connection with the project both at Minidoka dam where 50,000 acre ft. are available and at Jackson Lake in Wyoming where a capacity of 380,000 acre feet has been obtained by a low dam.

The first unit of the project to be constructed included 70,000 acres of land lying on both sides of the



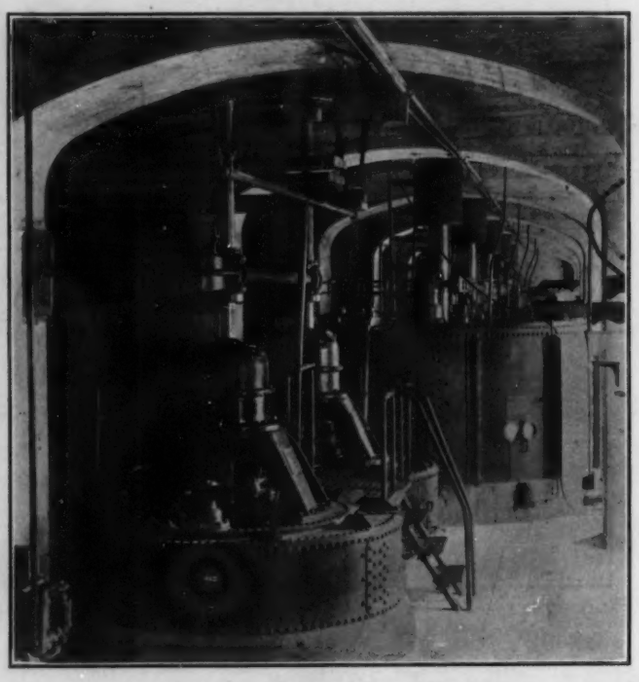
Jackson Lake Dam and Camp.

Snake River and covered by gravity canals. In 1908, the Reclamation Service was authorized to proceed with the construction of the South Side pumping unit covering 48,000 acres of choice bench lands, some of which lay as much as 90 ft. above the gravity canal. Some water was delivered in 1909.

Power House.

Power is developed at Minidoka dam under a head of 46 ft.; using the water which must pass down the river for prior rights.

Generator Floor of Minidoka Power House.



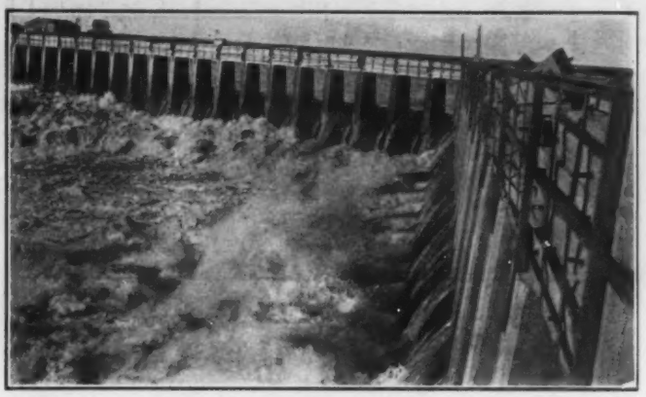
Turbine Floor of Minidoka Power House.

The power plant consists of five main units each having a capacity of a 2000 h.p. in the water turbines. These turbines drive electric generators which have a normal capacity of 1200 kw. each and which under a high head have delivered as much as 1600 kw. each.

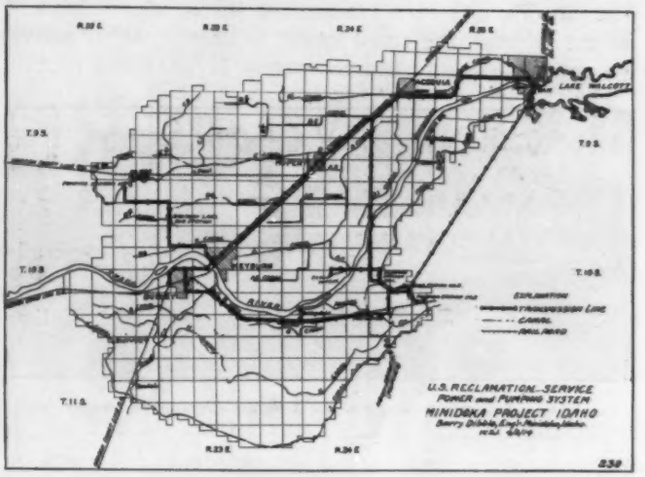
The power plant is situated in the channel which was built to carry the water of the Snake River during the time that the main dam was under construction. This diversion channel is now closed by a concrete dam which is used as the up-stream wall of the power plant, while the lower end of the channel is used as a tail-race. The water is taken directly from Lake Walcott, as the back water from the dam is known. Lake Walcott covers 10,000 acres and is used in the summer time as an auxiliary storage reservoir in which the water can be raised 5 ft. above the spillway crest of the dam by means of flashboards. When the lake is thus raised, additional head is made available at the power house and this is used to increase the capacity of the plant. By closely regulating the discharge of the stored water from Jackson Lake it is possible to so arrange that Lake Walcott will be at nearly its highest elevation at the time when the greatest amount of power is required for irrigation pumping. Water from the lake is taken to the turbines through 10 ft. penstocks, each of which carries approximately 500 cu. ft. per sec. when operating at full capacity.

Electric energy is generated at 2300 volts and carried by cables through fiber conduit to air-cooled transformers which raise the voltage to 33,000 volts for

transmission. All the wiring and switches beyond the transformers are in duplicate and all the way through the plant precautions are taken to prevent any accident from causing serious inconvenience.

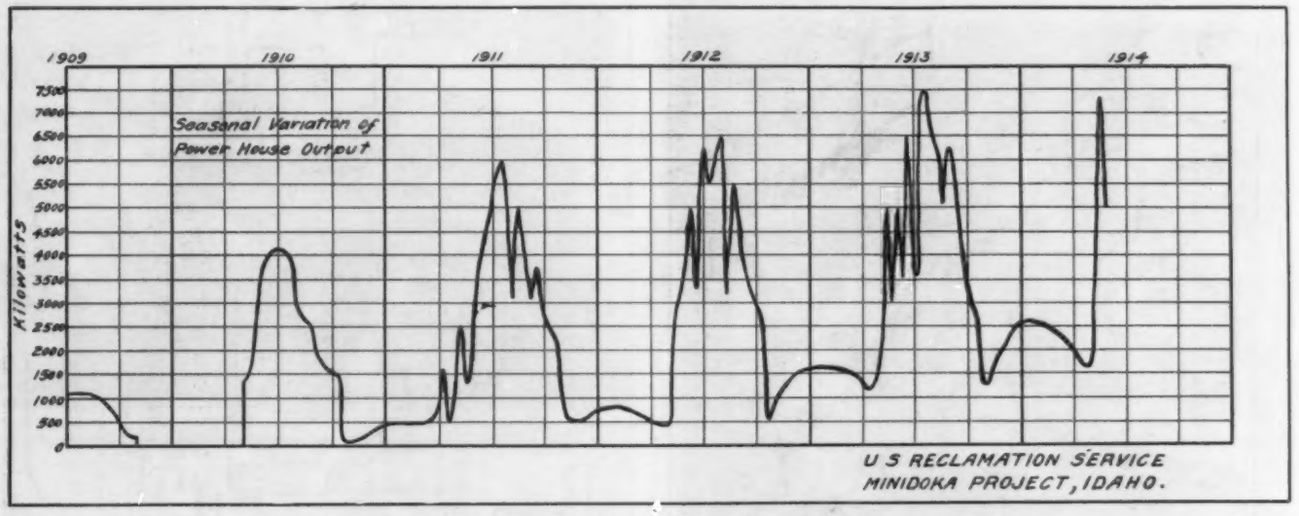


Minidoka Spillway.



Canal and Transmission Lines of Minidoka Project.

The accompanying curve shows the variation of the load on the power house with the seasons. The fluctuations in load during the summer are caused by the occasional rains which lessen the irrigation demand. The normal daily load curve is practically a straight line. During 1913, the output of the station reached 25,700,000 kw.-hr. with an observed peak of 7420 kilowatts, making the annual load factor 39.9 per cent. The annual cost of operation and maintenance amounts to approximately $16,000, or less than .07 cents per kw.-hr. independent of fixed charges.



Seasonal Variation of Load on Power House.

Transmission Lines.

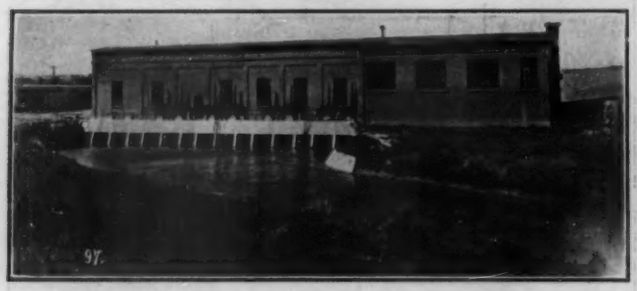
From the power house two transmission lines extend to the project; one going by way of Acequia, to Rupert and Heyburn, and then crossing the river to Burley, with a branch line from near Acequia which goes to No. 1 pumping station on the South Side. The other line goes directly from the power house across the river to No. 2 pumping station, a distance of about 11 miles. From there a line goes to Station No. 1 and another to Station No. 3. A new line built last winter goes from Station No. 2 to Burley and there connects with the original line from the North Side of the river. These two lines form a loop over which current can be supplied in either direction. From Heyburn a line extends to the West End pumping station near the west edge of the project. In all there are about 62 miles of 30,000 volt lines and over 20 miles of 2200 volt lines in the government system. These are supplemented by the distribution systems in each town and the lines owned directly by bodies of settlers. The annual cost of operating and maintaining the high tension lines is about $40 per mile.

Pumping Stations.

The pumping stations which supply water to approximately 48,000 acres of land are the largest stations which have ever been built for irrigation purposes. In fact, it is believed that the pumping stations of the city of New Orleans, which are used in case of severe rain storms to remove the storm water from the sewers of the city, are the only pumping stations which have a larger capacity than these on the Minidoka Project. The buildings of each station are of concrete construction and contain transformers for lowering the voltage from 30,000 to 2200. The buildings also house the motors and pumps.

Altogether there are ten pumps which were originally of 125 sec. ft. capacity, each driven by a 600 h.p. motor, and two 75 sec. ft. pumps driven by 360

h.p. motors. At each station the lift is approximately 30 ft., so that the third canal is nearly 90 ft. above the gravity canal. Approximately 127,000 acre feet of water were pumped during the season of 1913 and of this 17 per cent was used in the 30 ft. level, 36 per cent on the 60 ft. level, and 47 per cent in the 90 ft. level.



Pumping Station No. 1 From Forebay.

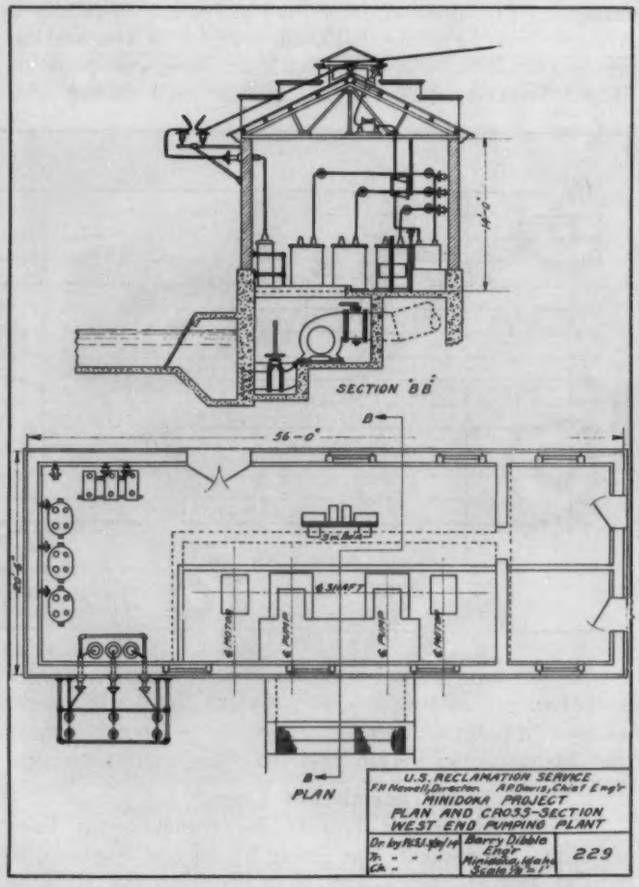
The average lift for the season was 68.3 ft. The power required was 15,900,000 kw.-hr. with a peak of 6550 kilowatts, corresponding to a load factor of 24.3 per cent. The cost for the year of operating and maintaining the three stations was $13,000 exclusive of fixed charges and of the cost of power, or a trifle more than ten cents per acre foot lifted the average height. The proportion of the cost of operating and maintaining the entire power system which is chargeable against the 48,000 acres of land comprised in the South Side pumping unit averages between 50 and 55 cents per acre per year. The cost of operation and maintenance of the canal system amounts to an additional 75 cents per acre.

Interior of Pumping Station No. 2.

According to past conditions there has been a very heavy demand on the pumping stations for a week or ten days in the middle of the summer. During this time all of the machinery has been pushed to the fullest capacity. Efforts are being made, however, to arrange by rotation to spread the demand for water over a longer period without hardship to the farmers and avoid the excessive demand for the very short period.

Pumping Station No. 1 Discharging 500 sec. ft.

During the winter of 1913-14 alterations have been made in several of the large pumps and recent tests indicate that the changes will increase the capacity from 125 to 165 sec. ft. and improve the efficiency of these pumps from 72 per cent to over 80 per cent.



Plan and Cross Section West End Pumping Plant.

Each of these pumping stations is operated twenty-four hours a day with three eight hour shifts with one man on each shift at each station. A foreman has general charge of all three stations.

Smaller pumping stations are located on the North Side Gravity Unit to cover small isolated high-land areas which cannot be reached economically by the canals. The West End Pumping Station is installed

to water about 2200 acres. It has a capacity of 40 sec. ft. and lifts the water about 18 ft. Two horizontal units, each driven by a 75 h.p. motor are contained in the plant. The station is designed to be as nearly automatic as a station can be built and requires attention from an operator but once a day. This is given by the ditch rider who distributes the water supplied by the pumps. Advantage was here taken of the contour of the ground to locate the pumps, and therefore the motors, below the level of the intake canal. This makes the pumps self priming and avoids the necessity for foot valves. The trifling leakage into the pump pit is drained off to adjacent low ground.

At what is known as the A-4 raise a scoop wheel is used to lift about 20 sec. ft. of water 4 ft. to irrigate some 800 acres of high-land.

Numerous drainage pumps driven by motors have been in use for some time at various points on the gravity unit to keep down the ground water level until permanent gravity drains can be completed. It will be necessary to put a permanent pumping plant for drainage purposes at what is known as Boersch Lake on the line to the West End, where drainage water flows into a pond or sump which is several feet below the normal river surface, making it impossible to drain it by gravity.

Electric Drag Line Excavator With Catapillar Traction.

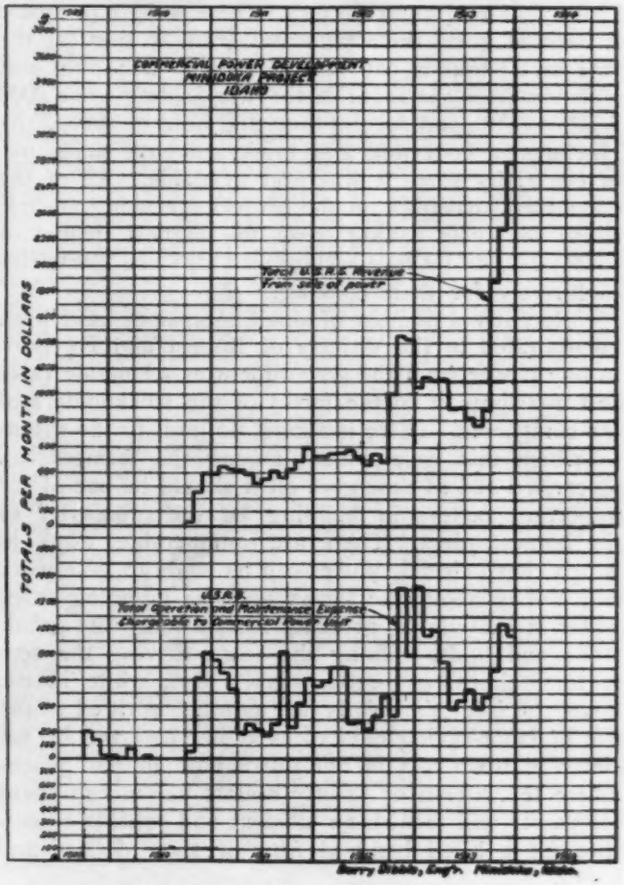
Electric Drag-Line Excavators.

An interesting feature of the use of electricity in connection with the drainage work on the project is on the electric drag-line excavators which have been in use since September, 1913. These machines have buckets of 1½ yds. capacity and pick up, swing and dump once every 30 or 35 seconds. They are mounted on caterpillars driven by the hoisting motors so that they move along without any other assistance, leaving in their trail deep drainage ditches and rapidly lowering ground water. They require from .35 to .50 kw. hr. per cubic yard excavated.

Commercial Development.

Early in 1910, contracts were made by the government to deliver power at 2200 volts to distributing companies in each of the principal towns of the project. Delivery of power under these contracts was begun during the month of October, 1910. So great has been the growth of business that in order to take care of the load the equipment of the substations was doubled in 1912, and during the past season a new transmission line was built from Pumping Station No. 2 to Burley and a new substation of 1275 kw. capacity installed at Burley, while at Rupert the capacity of the substation was more than doubled again, making it of 1275 kw. capacity.

The shape of the irrigation load curve, requiring a high capacity in the summer and no load in the winter, made it desirable to offer low rates to encourage the development of the winter-load. In these small sage-brush towns, which even now have a combined population of less than 3000, it appeared highly improbable that the use of electricity in the ordinary


COMMERCIAL POWER DEVELOPMENT
MINIDOKA PROJECT
IDAHO
TOTALS PER MONTH IN DOLLARS
Total U.S.R.S. Revenue from sale of power
U.S.R.S. Total Operation and Maintenance Expenses Chargeable to Commercial Power Use
Barry, Dibble, Engrs. Minidoka, Idaho.

Commercial Power Development of Minidoka Project.

ways would ever amount to enough to warrant the operation of the power system throughout the non-irrigation season. Electric heating of the buildings and dwellings of the towns offered a new field which promised load in large blocks. In 1910, there was no commercial demand for large electric heaters and none were on the market. The government engineers undertook to study the problem of heating houses and buildings with electricity and for this purpose designed suitable heaters. The electrical manufacturing companies, however, were quick to grasp this opportunity and now there are several of them which are turning out complete lines of heaters which they ship in large quantities into this section.

During the last few years electric cooking has also made a great advance and while the rather high cost of the appliances has held back the growth of this business on the project, yet electric cooking is prov-

ing so satisfactory and convenient that more and more of the complete electric ranges are being installed. In fact, electricity is proving a great boon to the housewives and is fast becoming a necessity not only for lighting, but for cooking, heating, washing, ironing and sewing. The most elaborate installation yet attempted is that of the Rupert High School with a connected load of 435 kilowatts described in this journal April 11, 1914.

At Burley the factory of the Amalgamated Sugar Company is using over 200 kw. for power and lights in changing the beets into the best grade of white sugar. Electric power has been found particularly desirable for the centrifugals. Recently the Portland Feeder Company has installed an alfalfa mill in the vicinity of the sugar factory, where a 50 h.p. motor is used to grind the alfalfa and grain to meal at the rate of 30 tons a day and to mix it with pulp and molasses from the sugar factory for feeding some 2000 head of cattle and several thousand head of sheep. At Heyburn, a flour mill and brickyard have made use of electricity since it was first available. All of the commercial bakeries on the project are using electric ovens for their baking, with the highest degree of success. The leading restaurants also use electricity exclusively for their cooking.

Recently a number of small companies have been incorporated in the vicinity of Rupert and Heyburn to buy power from the government at wholesale rates and distribute it to the farms of the stockholders of the companies. There is almost no limit to the extent to which this development among the farmers can be carried and as time goes on it should be one of the important factors in building up the prosperity of the homesteaders. There are innumerable ways in which cheap electric power can be made to save work and money about the farms, such as pumping stock water in the winter, grinding feed, driving the grindstone and tools, milking the cows, driving the separators, churn, or bottle washer, etc., while in the home the farmer's wife is just as much entitled to the use of labor-saving devices as is her husband or her sister in town. It is not uncommon to find places where ten, fifteen or twenty dollars per month spent for power will furnish an efficient and reliable substitute for a hired hand at fifty or sixty dollars and board.

It is evident that the United States government is not the ideal form of organization to economically handle the retailing of electrical power to small consumers. Therefore the policy has been adopted of aiding the farmers to form these mutual companies which build their own lines to connect with the government system, install their own house transformers and handle the retailing of power. The government then delivers the power to these companies at some suitable point. The electrical department of the project stands at all times ready to assist the small companies to build their lines, to make their repairs, to build up their load or to aid them in any way possible. In fact, the electrical department usually takes the initiative in encouraging the farmers to find new uses for power.

These rural lines cannot yet be considered a profitable investment from a power company standpoint. However, they enhance the value of the farms which are reached by the lines and the material saving to the farmers which comes from the use of electricity makes this investment a good one from the farmer's standpoint. The delivery of power to the farmers has only been started, but with the increased prosperity of the country it is expected that it will show a very healthy growth. Considering the fact that in the past eight years the present towns and farms have all grown from a sagebrush desert, the following outline of the commercial load connected to the government system on January 1, 1914, forms an interesting comment on the progress which has already been made in these communities.

Commercial Power Load.

Apparatus Connected December 31, 1913.

Items.	Units.	Kw.
60 Watt Lamps or equivalents	5,745	344.7
Flat Irons	236	118.4
All Night Arcs	5	3.
Heating (consumers)	291	1,573.1
Toasters	15	8.4
Hot Plates	11	16.17
Vacuum Cleaners	10	1.5
Ranges	24	83.04
Bake Ovens	3	33.2
Water Heaters	13	22.2
Small Motors	21	11.3
Picture Machines	5	15.
Coffee Urns	4	7.4
"X" Rays	1	3.
Rectifiers	1	1.1
Motors (1 h.p. and over)	47	618.62
Total Dec. 31, 1913		2,860.13
Total Dec. 31, 1912		1,691.37
Per cent increase for year 1913		78.5
No. of consumers connected Dec. 31, 1913		686
No. of consumers connected Dec. 31, 1912		492
Per cent increase for year 1913		39.4

The following rates are made for electrical power on all new contracts. The schedule has been so arranged that it applies to all customers, large and small, wholesale and retail. The discounts are frankly based on the estimated difference in the cost of service. The rates are designed to encourage a good load factor and an extended use of power.

Abstract of Standard Rate Schedule.
Light, Power and Appliance Rates.

Apply to energy used for all purposes unless special provision is made to take advantage of lower rates for heating rooms and buildings.

$2.00 per month per kw. for 50 hours use of maximum demand.
.03 per kw.-hr from 50 to 100 hr. use of maximum demand.
.02 per kw.-hr. from 100 to 150 hr. use of maximum demand.
.01 per kw.-hr. from 150 to 300 hr. use of maximum demand.
.005 per kw.-hr. over 300 hr. use of maximum demand.
25 per cent additional during June, July and August.
Maximum demand based on 15 minute peak.
½ kilowatt is smallest quantity contracted.
Quantity discounts varying from 2 per cent for a 2 kw. load to 30 per cent for 100 kw. and over.
10 per cent discount if energy is delivered and metered at 2200 volts.

Special Heating Rates.

Apply only from September 1 to June 1 to power that is separately metered and used solely for heating rooms and buildings.

$1.25 per kw. per month at 220 volts.
.75 per kw. per month at 2200 volts.

Each heating device connected must be paid for for a minimum period of four consecutive months.

Or as an alternative a demand meter may be installed to show the greatest load used each month. In this case the maximum for the season must be paid at least four months.

The light, power and appliance schedule it will be noted is based on the load factor principle and avoids the necessity for separate meters for power used for different purposes. It has been found very satisfactory in building up desirable load and in encouraging the small consumers to add to their current consuming devices without materially increasing the transformer capacity needed.

At the present time the permanent investment in the Minidoka power system is as follows:

Power plant and accessories	$ 475,000
Office, shop and storehouse building	9,000
South side pumping station	420,000
Pumping station, gravity unit	21,000
Transmission lines	73,000
Substations	42,000
Total	$1,110,000

SELLING ELECTRIC SERVICE

"THE THREE TYPES OF MANAGEMENT."

BY E. ST. ELMO LEWIS.

(This is the last of a series of three articles on Management by Mr. Lewis, who is President Detroit Executive's Club and advertising manager Burroughs Adding Machine Company. The first article in this series appeared in this Journal for May 30, the second on June 20, 1914.—The Editors.)

The Efficient Management.

The efficient manager has one object constantly before him—the elimination of waste. He realizes that every bit of material in his place can be used at 100 per cent efficiency or less; that every bit of energy that he pays for can be used at 100 per cent efficiency or less; and that time can be used in the same way.

He knows that things do not happen, that there is a cause for every effect.

He knows also that men can be taught, for he is teaching them. He knows that stenographers in an office can be taught accuracy, speed, English, or how to write a letter. He takes from his department manager the time wasting job of acting as primary school teacher to his stenographers.

He knows that foremen should simply supervise, they should not be expected to teach men the best ways of doing work. He knows that men vary in capacity, but he knows also that men learn to do better work at twenty-five than they did when they started as apprentices; that the best men have a certain way of doing things that can be taught to others, are therefore a plant can be taught how to increase production. It is a question of analysis, planning and executing. Therefore he goes at the proposition of raising efficiencies in a definite, concrete, tangible way, something like this:

1. He makes time studies of the work.

2. He places these studies in the hands of trained thinkers and scientific men who plan the work and fit the schedules.

3. He establishes the idea of functional foremanship.

4. He makes improvements in shop methods necessary to get the greatest possible product from the worker.

5. He puts a wage system at work that will place a premium upon a man who exercises the greatest efficiency. A big problem? Of course it is, but it must be solved as nearly as may be, must it not? Its bigness does not effect its pressing call for a solution.

The efficient manager, after analysis, adopts a plan starting with the Taylor System, or the Emerson System, or any one of many which all come under the general term of scientific management. He starts from somewhere to go somewhere in his management. Suppose he decides to start with the Emerson System. He tests his present management against the twelve Principles of Efficiency as Mr. Emerson calls them:

1—Definite Plans and Ideals.
2—Supernal Common Sense.
3—Discipline.
4—Competent Guidance.
5—The Fair Deal.
6—Despatching.
7—Reliable and Adequate Records.
8—Determination of Standards.
9—Standard Practice Instructions.
10—Standardized Conditions.
11—Standardizing Operations.
12—Efficiency Reward.

While this is not a treatise on efficiency but on cost keeping efficiency, intended to show how to eliminate the waste of time, work, thought, material (all of which spell m-o-n-e-y in business) in the handling of costs, yet it is necessary to explain the philosophy of efficiency if we are to handle costs efficiently.

No manager can escape the necessity for knowing the value of what he does when it comes to costs any more than he can of any other part of his work.

"Increase the net," is the cry.

This manager realizes that all work in a factory, in an office, goes by dependent sequence. No man's work stands alone.

The other day a manufacturer was asked what he thought his efficiency was in different departments. He said that "He thought that his efficiency was 75 per cent at least," and he forgot the law of dependent sequence. If the raw stock department was 75 per cent efficient, and the department to which it first went 95 per cent efficient and the next two were each 75 per cent efficient at the end of the fourth operation, the end result would be only 40.1 per cent efficient. If each of the four departments were 80 per cent efficient, the end result would be 41 per cent efficient.

If one department were 75 per cent efficient and another department were 125 per cent efficient, the end efficiency would only be 93.75 per cent efficient. The efficient manager, therefore asks of the cost department such records as will assist in the establishment of a complete record of the efficiency and of how it has cost to gain the amount of efficiency that has been attained.

Values must be established as well as costs, and for this purpose we must have every order that goes through a plant, every function of department standardized, establishing the best as a standard of value, by which to judge our efficiency.

Out of that will come the best—

1. Rate of pay for each man or woman.

2. Number of people to be employed in doing a particular work.

3. Kind of men for each kind of work.

4. Standard time for the operation. These standards should be indicated on the same records by which the system tells the actual things that were done in the work. In other words, it should show standards as well as performance on each record.

If the comptroller is necessary to show where money goes, then the efficiency manager is necessary to show what is obtained for the money. The cost accountant should be concerned principally with arranging his systems of cost-keeping so that reliable, immediate, and adequate records may be kept of the value of the commodities received for the money invested.

The same record should show:

(a) The comptroller or auditor where the money goes.

(b) The manager where standards of value have been realized, and where losses are occurring in time, labor and material.

In the past the cost accountant has too frequently been merely a man of figures, having little or no conception of what the figures really meant. He was essentially a bookkeeper who didn't know the significance of the things he was handling, and he was only concerned with totals, averages, percentages. So long as he secured his balance, he was satisfied with his results. He knew of no standards for comparing with values and failed to realize that balance sheets should be used as efficiency charts. Balance sheets can be veritable mines of misinformation. Paper profits have mislead many a manager.

A plant can be made to show fine profits on the balance sheets for a time. Efficiency charts would show up the starvation at a glance.

Before the cost accountant can become efficient, the management must become efficient. If the management is not efficient, the cost work will not be organized, functionalized, so that it can reflect truly, adequately and completely the real value of the business performance. Therefore, the cost accounting has to reflect what is actually being done. No matter how efficient the cost accountant may be, he cannot make an inefficient plant, or an inefficient organization, efficient. He can reflect only what an organization is doing, showing blanks for those kinds of records which the management handling the business does not permit him to make.

On the other hand, no matter how efficient may be the plan or organization, no matter how efficient may be the individual member of the organization, if the cost accounting records are not efficiency records, there will never be any adequate information placed before the comptroller, or the general manager, that will give them an opportunity to accurately gauge, in the first place, what has been received for the money, and in the second place, where inefficiencies may be eradicated.

The manager under any efficient plan of organization must realize that wastes, principally those which he does not now see, are the most vital concern of management. The "doer" type of American manager wants volume of production, volume of sales, volume of this and volume of that. He doesn't realize that efficiency is concerned with the net. That is the final as well as the primal test of his efficiency, of his real worth to the organization.

An engineer of national prominence said the other day, "It is absolutely bewildering to note how managers will permit continuous, relatively large wastes to continue rather than incur a pay roll expense that will stop it." Let such men understand that waste is the largest "fixed charge" in most factories.

The efficient manager will therefore develop his cost system along the line of obtaining efficiencies as against standards set up by those who are most familiar with what machines and skilled men can produce when all these highest efficiency of production.

He knows a cost system to be a means to an end, and not an end in itself.

He knows that knowing costs is but the beginning of knowledge, and that unless he has some ideal standards with which to compare his costs he is still running the business with but half the information necessary to realize its greatest possible success.

What is the real difference between the rule-of-thumb manager and the systematic manager?

The former guesses at what happened and the latter knows what happened. Neither necessarily knows what the value of the happening really is—the latter knows what it cost, the former can't be sure, but he can pay his bills—sometimes.

The difference between the systematic manager and the efficient manager is fundamental. The former occupies his time in writing history. He is thinking of yesterday; he is always at least one day behind the work; generally he is from a week to a month behind.

The efficient manager is writing prophecies. He is scientifically determining what is going to happen the day after tomorrow. He is systematic too, but his system is projected into the future. He does not care what happened last week. He is never later than today. He was preparing for today six months ago.

Step into a great business—get behind the scenes a moment, peer into the laboratories. There are unique furnaces for steel making, there are schools for man training, there are machines that will not be placed on the market for five years—there are careful analysis of markets to be developed two years from now.

The researches are being made—men with note books and open ears and eyes are traveling—engineers are experimenting—all preparing for tomorrow.

When the day comes these managers go ahead methodically developing their day-before-yesterday plans, and the game of doing business pays for the prophetic vision. As battles are not fought under the inspiration of the moment, "so the efficient manager never waits for the fighting. He always forces it."

That is the difference between the various types of managers—the difference between their business—the difference between their cost systems. It appears in the net!

A kite wire telephone solved the difficulty of keeping up the wires when a flood in the Salinas River district, California, recently washed away pole after pole. The telephone company's men carried a bridle wire across the river by means of a number of large box kites and then used this strand as a messenger for drawing the telephone wires across. Talking was carried on successfully over this kite line until the recession of the water permitted the laying of a permanent cable.

Electric welding by the resistance process is accomplished by passing an electric current of large amperage at low voltage across the junction of the pieces to be welded. From 2000 to 50,000 amperes at from 1 to 7 volts are used in welding from ¼ in. to 3 in. round or equivalent section. The heat is generated in the metal because of its resistance, which increases as the heat increases, the greatest amperage being necessary at the beginning of the heat effect. Usually no flux is required. The process is more applicable to new work than to repairs. W. A. Hedges presents a paper in the June, 1914, Journal of the American Society of Engineers which more fully tells of the advantages of electric welding and its application.

ELECTRICAL DEMONSTRATIONS.

BY E. L. ARNOLD AND D. B. MUNROE.

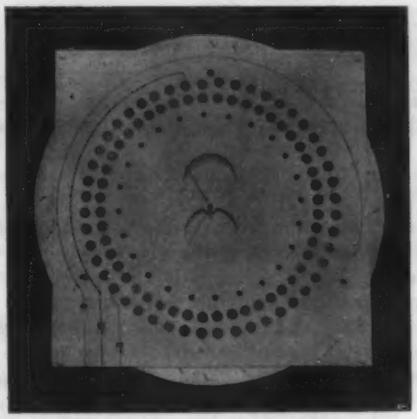
(These demonstrations for class room work were presented as a thesis to the University of Southern California for the degree of Bachelor of Science in Electrical Engineering, and delivered as a paper at the last meeting of the Los Angeles Section, A. I. E. E., by the authors.—The Editor.)

Proposition III—Induction Motor.

The object of this demonstration is to show simultaneously the different actions that are occurring in the induction motor. A four pole three-phase induction motor was chosen as the basis of the demonstration; having 48 inductors in the stator winding, and of the squirrel cage rotor type.

The model was constructed so that for the different desired positions the direction of current in the various coils of each phase can be readily determined as well as the relative strength of this current; also for these same positions the position of the four rotating poles with respect to the stator windings and the strength of the magnetic fiield under each group of coils in each phase.

This was accomplished by having a stationary part on which was represented the windings of the stator, and colored in the three different colors, red, black, green, one color for each phase. Each inductor of the stator was represented by two circles painted in the color corresponding to that particular phase and grouped in combination of four inductors.



Model of Induction Motor.

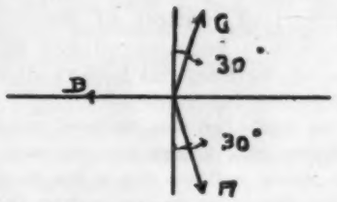
Connections were led in from one corner to the three different phases represented by their respective circles and connected to the different phases at an angle of 120 degrees. Where these connections appear on the stationary plate, three holes, one in each representative line wire, were cut and under which the revolving element appeared. In this manner by means of arrows the direction of current whether flowing in on a certain phase or out could be readily seen.

Another opening was placed in the middle of the band of inductors where the connecting wire was tapped in and on the rotating members. Placed so they would appear under this opening, were either a cross or a dot used to indicate the direction of the current in the coils.

A series of holes were bored in front of these coils through which the position of the field could be found and its rotation made evident when the moving element was rotated. A certain position of the moving part was chosen to enable the position of the poles to be determined after which they rotated in unison with the change of current in the phases.

In order to do this readily a position was taken so that there was no current in one of the phases, for example phase B.

Then current in phase A is flowing out and in C it is flowing in and both currents are of the same strength.



Representative Diagram.

By construction of a representative diagram and superimposing the vector of the magnetizing flux in stator iron for a given position the north pole was found to lie directly in front of the "feeding in" band of the stator inductors that were carrying no current or, in other words, in front of the B phase.

Having determined the position of one of the poles the other three were at right angles to it and each other and were so laid out. This gives the strongest point of the field and so it was colored deep at this point and shaded off to zero and another color used for the south pole which began at this zero and reached a maximum at 90 degrees away from the original north pole. This enables one to see the field where it is the strongest and where it gradually reaches zero and builds up in the opposite direction. Near the center two large circles were cut in the stationary part, with their centers on the same line, and each circumference passing through the center of the fixed member.

Three vectors were drawn from the center at 120 degrees apart and in the colors and order of the three phases previously mentioned. The length of these vectors from the center to where they passed under these large circles is proportional to the strength of the current at that instant in the phase that is of the same color as the vector considered.

The method of obtaining the above arrows on the rotating member was by putting the stationary part in place and rotating the member the desired amount and the conditions for that position ascertained. And so on until the entire 360 degrees had been covered.

The traction resistance of a 28-ton electric car has been found by the University of Illinois to be $R = 4 + 0.222S + 0.00582S^2$ when R is resistance in pounds per ton and S the speed in miles per hour. More definite account of air resistance is given by the formula $R = 4 + 0.222S + 0.00181\frac{A}{W}S^2$ when A is the cross-sectional area of the car in square feet and W is the car weight in tons. These formulae are the equations of a parabola which closely approximates the curve of actual observations. They apply to speeds between 5 and 45 miles per hour.

MONTEREY GAS DECISION.

Case No. 499—California Railroad Commission.

Regarding the claim of the City of Monterey, California, that the rates charged by the Coast Valleys Gas & Electric Company are unjust and unreasonable, Commissioner John M. Eshleman, under date of June 30, 1914, finds that the rates are unjust and unreasonable and orders a rate of $1.30 per M. cu. ft. for the first 5000 cu. ft. per month per meter, and of $1.00 for all over that amount. As his accompanying opinion enunciates important matters of commission policy the major portion is here reproduced in full. After a brief review of the financial history of the company and its predecessors, he continues:

None of the books of the various predecessor companies were offered in evidence nor was any testimony introduced which would indicate either the book value or original cost of the properties or any portion thereof acquired by the defendant in this case, nor whether or not sinking funds for the redemption of the several issues of underlying bonds had been set up by these predecessor companies prior to the actual transfer in each case and no material evidence is in the record tending to establish what the fair or market value of the stocks and bonds of any of the predecessor companies was originally or at any subsequent time. In view of the above statement it will be evident that the mere fact that so much stock and so many bonds were issued by this defendant or even that so much money was expended is of little assistance in attempting to determine a fair value to be placed on a particular portion of the properties so acquired for the purpose of this case.

Defendant presented at the hearing inventory, valuation and rate reports prepared by Ford, Bacon & Davis, engineers, covering all the existing properties of the Coast Valleys Gas & Electric Company as of August 31, 1912, with additions and betterments to December 31, 1913. A summary of these reports, in so far as the gas plant and system at Monterey and Pacific Grove are involved, together with a summary of the valuation report prepared by Mr. A. R. Kelley of the commission's engineering department, is given in Table I.

Table I.
Estimated Cost to Reproduce New.

	Ford, Bacon & Davis.	A. R. Kelley
Real estate prorated to general structures	$ 1,250.00	$ 1,250.00
Real estate prorated to gas plant	6,666.66	6,666.66
Office buildings and general structures (prorated)	1,750.00	1,750.00
Gas plant buildings and structures	8,217.00	(a) 8,706.50
Holders	2,289.00	2,200.00
Furnaces, boilers and accessories	5,513.25	5,513.25
Gas generators	2,383.00	2,383.00
Purification apparatus	3,991.90	3,961.00
Accessory equipment at works	1,329.65	1,221.95
Boosting and regulating apparatus	4,469.23	4,469.23
High pressure mains	4,537.02	(b) 3,695.37
Low pressure mains	42,255.84	25,878.81
Gas services	10,331.58	6,885.72
Paving	26,352.22	.....
Service regulators	2,017.81	1,899.25
Gas meters	7,211.36	6,091.90
General office equipment, etc. (prorated)	882.92	882.92
Stable and miscellaneous equipment (prorated)	431.10	431.10
Total tangible capital less overhead expense	$131,879.54	$83,886.66
1—Contingencies, incomplete inventory, etc.	11,037.44	6,300.05
2—Contractors' profit	12,155.14	
3—Engineering and supervision	10,937.72	
4—Interest and taxes during construction	17,431.05	
5—Injuries and damage	2,340.00	
6—Rights, capital and organization and going concern	65,800.00	
7—Engineering, supervision, organization, legal expenses and taxes during construction		9,018.68
8—Interest during construction		2,976.15
Total overhead and intangible	$119,701.35	$18,294.88
Total estimated reproduction cost	251,580.89	102,181.54
Materials and supplies	1,584.00	1,584.00
Additions and betterments:		
Gas generators	5,003.00	5,003.00
Purification apparatus	2,080.00	2,080.00
Low pressure mains	2,110.00	2,110.00
Gas services	746.00	746.00
Total additions and betterments	$ 9,939.00	$ 9,939.00
Total to December 31, 1913	263,103.89	113,704.54

(a) Including $489.50 for an oil tank listed with electrical equipment by Ford, Bacon & Davis.

(b) Including 3 district regulators at $125 each, not included in this item by Ford, Bacon & Davis.

It will be noted that the overhead charges estimated by Ford, Bacon & Davis amount to something over 40.8 per cent of the sum of unit costs placed by them on the physical property and that in addition to the overhead allowances shown, intangible items, including "Rights, Capital and Organization and Going Concern," etc., are included which brings the total overhead and intangible values claimed to over 90 per cent of the estimated bare physical cost. Not only does the defendant ask that all of these intangible items be allowed in fixing a rate to be charged by it for gas in the city of Monterey, but the commission is also asked to allow 10 per cent return on the full estimated reproduction cost, including all the overhead and intangible items, large appreciation in real estate values, the estimated cost of paving over mains and services, which expense was never incurred by this defendant or any of its predecessors, and, in addition, a largely increased depreciation annuity to amortize an amount said to represent the accrued deficit in depreciation reserve, from the original organization of the predecessor companies to the present time. The accrued depreciation in the gas plant and system at Monterey and Pacific Grove on August 31, 1912, as shown in a report prepared by Ford, Bacon & Davis is estimated to be $43,980.61

It is interesting to note the manner in which a strict reproduction new theory is utterly disregarded by the engineers employed by the company at times and again adhered to tenaciously when that theory will best serve to justify the various estimates and claims of defendant. In increasing the depreciation annuity to compensate past alleged deficits, the engineers have entirely abandoned the reproduction new theory and adopted the historic method which attempts to arrive at the original cost of the plant as it now exists.

Mr. Kelley submitted an estimate of the cost to reproduce the property new and there appears a wide difference in opinion between Mr. Kelley and the engineers for the company as to the cost of certain portions of the plant. In so far as the gas plant and buildings are concerned, the unit costs used by Mr. Kelley and the company's engineers compare very closely and in several, if not the majority, of the items Mr. Kelley has accepted and used those appearing in the Ford, Bacon & Davis appraisal. The present value placed on the real estate prorated to the gas plant at Monterey, however, being one-third of $20,000, appears from the evidence to be excessive and I am of the opinion that $15,000 would be a very liberal allowance for the whole tract at this time, or $5,000 to be prorated to the gas plant on the company's basis of segregation. The original cost of this property, comprising the entire block with the exception of one lot, was not made clear but was probably not less than $2500 or more than $5000.

Paving over mains and services, amounting to $26,352.22, not including overhead, has been included in the Ford, Bacon & Davis report and very properly omitted by Mr. Kelley. This commission has heretofore on several occasions indicated its position in regard to this item where it represents no actual expenditure made by the present or a previous owner of a property, and I do not deem it necessary at this time to discuss at length the reasons for not allowing the item in cases such as the present one.

The different unit costs used by the Ford, Bacon & Davis engineers and Mr. Kelley for street mains and services, ac-

count largely for the great difference between the two total reproduction costs arrived at, and I am of the opinion that those used by Mr. Kelley are at least liberal for the class and character of the work contemplated in his report. Mr. F. C. Millard, appearing for defendant, testified concerning the value of the gas plant and system supplying Monterey and Pacific Grove, and while the hasty manner in which his investigation of the properties was carried on rendered his report of little value to the commission in determining the issues of this case, it recalled one point worthy of attention, namely, that some of the street mains were "Converse" pipe and not the standard black pipe used exclusively in the more recent installations. I will allow $800 over and above the costs found by Mr. Kelley for the difference in price on pipe as noted. The labor costs used by Mr. Kelley, while much lower than those used by the company's engineers, appear from records of actual construction in Monterey and Pacific Grove to be ample even before the addition of overhead charges.

The cost of installing gas meters was a point on which Mr. Kelley differed greatly from the engineers appearing for the company, who maintained that $2.00 was a reasonable amount to be allowed for this item. Mr. Kelley contended that 50c was ample although he used 75c in arriving at the cost of meters installed. To my mind there can be no question but that the cost used by the company's engineers is excessive and that the figure used by Mr. Kelley will in all probability exceed, without the addition of overhead, the actual cost to the company.

Both Mr. Kelley and the engineers for the company have, through error, included electrical instruments estimated to cost $78.75, and this item should be deducted from both estimates after being increased for the overhead allowed in each case.

The question of overhead expense was discussed at length by engineers for the company and Mr. Kelley, and, as usual, there appeared a great difference of opinion as to the proper percentages to use in the case of each item and in the aggregate. A comparison of the percentages used in shown in the following table:

Table II.—Percentages of Overhead Expenses.

	Buildings, etc.	Real Estate....	Gas Plant Equipment..	Services	Street Mains...	Meters	Tools and Misc.
Ford, Bacon & Davis:							
Contingencies	0	10	10*	10	10	5	5
Contractors' profit.....	0	10	15	15	15	0	0
Engineering and supervision	0	7½	7½	7½	7½	7½	0
Interest and taxes.....	10½	10½	10½	10½	10½	10½	10½
Apparent total.....	10½	38	43	43	43	23	15½
Actual cumulative total	10½	43.7*	50*	50*	50*	24.7*	16*
Kelley:							
Contingencies	0	10	10*	10	10	5	5
Engineering, supervision, organization, legal expenses and taxes	10	10	10	10	10	10	10
Interest	3	3	3	3	3	3	3
Apparent total.....	13	23	23	23	23	18	18
Actual cumulative total	13 1/3	24.6*	24.6*	24.6*	24.6*	19	19

*No contingencies on boilers and 5 per cent on boosting and regulating apparatus.

I have hereinbefore referred to the fact that the general effect of the overhead percentages used by Ford, Bacon & Davis is to increase the estimated bare costs of all the gas properties in Monterey and Pacific Grove, including real estate, over 40.8 per cent, while those used by Mr. Kelley will increase the estimated costs, less overhead, over 21.8 per cent. While on the whole Mr. Kelley's overhead percentages, with the exception of that for contingencies, may be considered as being at least fair under the circumstances of this particular case, including as it does the item of "organization," it is my opinion, in view of the unit costs used, that the allowance for contingencies is entirely too high. A percentage not to exceed 5 per cent of the estimated bare physical costs, less real estate, meters, general office equipment, tools and miscellaneous, would have been amply liberal and would, in all probability, considerably exceed the actual original cost. Mr. Kelley has allowed about 13 1/3 per cent overhead on a greatly appreciated value of the real estate owned by the company and while such an allowance may, in some measure, be justified on a strict reproduction theory, I do not believe it should be allowed as an element of value in this case.

Intangible values claimed by the defendant company, in so far as the gas properties in Monterey and Pacific Grove are concerned, are estimated by the engineers for the company at $65,800 under the terms "Rights, Capital and Organization" and "Going Value." Using the same ratio as shown in the report prepared by Ford, Bacon & Davis for the purpose of segregating the item "Other Than Physical Property $65,800.00" into its principal component parts, it is found that the values claimed are:

Rights, capital and organization.....$36,370.69
Going value $29,429.31

Organization expense has been provided for by Mr. Kelley in his overhead allowance.

The item "Capital" is presumably working capital, and can be amply provided for by allowing two months' operating expense at $3,586.00 on the basis of the company's statement for the year 1913, in addition to "Materials and Supplies" $1584, as reported. If interest for one-half of one year is allowed on construction, I can see no reason for allowing any working capital for that purpose other than materials and supplies ordinarily kept on hand.

There remains then the item of "Rights," which may be assumed to cover the cost of franchises. The evidence does not disclose what was paid for any franchise under which this company operates. Quite probably little or nothing was expended for such purpose.

The question of what constituted "Going Value" is largely a matter of opinion and the only evidence aside from the highly theoretical assumption by the engineers for the defendant appears to be that no depreciation reserve has been set up to provide for the ultimate replacement of each element of physical property at the end of its useful life.

On a strict reproduction theory it is difficult to understand how the question of past deficits can be considered or why, if such deficits actually occurred and if, contrary to the usual practice with small companies such as the predecessors of defendant, they were not occasioned by the investment of surplus earnings in plant, the present owners should be re-imbursed for losses borne by former owners of the property. At any event, it is not clear to me how early losses can add to the present value of this or any other plant. The whole trouble in this and many other cases before the commission, is that engineers representing utilities will not be consistent. Because a property has lost money certainly does not make it more valuable, although it of course makes it more costly, and the only theory upon which losses could be considered at all in rate fixing is on the theory that cost should be the basis upon which rates should be determined; and the justification for the cost basis for fixing rates is found in the fact that when any one incurs an expense for another, he has a right to expect to be reimbursed. In short, considerations of equity are the only ones that should appeal to a governmental agency in endeavoring to determine a basis upon which an earning shall be allowed. This commission should always be ready to give consideration to every equitable claim of a utility, whether it could be forced to do so under a strict interpretation of the law or not. And on the other hand, it certainly is a peculiar attitude to be assumed by any one who desires to give or receive fair treatment, to say that considerations of equity must be controlling upon this commission in fixing rates when such equity is in favor of the

utility, but that no account should be taken nor consideration given to equity when such a procedure would tend in anywise to decrease the amount upon which an earning is desired to be made.

It should be understood by utilities and the public alike and recognized by commissions and courts that when you take away from an enterprise the right to determine for whom and for what price it will conduct its business, you have eliminated the possibility of applying the same rules of value as obtain in an unregulated enterprise. Value, as commercially understood is something which cannot be determined until after the earning power is determined and the fact upon which commissions are asked to find, when asked to find value as commercially understood, is a fact which finally has no existence until after the authority of the state has been exercised in determining the proper conditions upon which the business shall be conducted, the proper rates, and so the earning power. The sooner it is understood by the utilities that under modern conditions they are literally at the mercy of the state, the sooner they will realize that only equitable considerations are the ones that will finally have weight, and until commissions and courts representing the sovereignty of the state realize that always they should make the "ought" determine the "must" such governmental agencies have not become equal to their task. I do not mean to suggest that any agency should be subject to the caprice of governmental authority, but I do insist that it should be recognized as a plain fact by the utilities that they are subject to regulation and that the character of such regulation and its extent will be largely determined by the attitude of the utilities themselves.

It is inconceivable to me how any engineer or how any utility could expect public officials of any intelligence whatsoever to accept exaggerated so-called "values" such as the one here presented, wherein every principle of consistency is violated and every known method of loading resorted to in order to increase the amount upon which an earning shall be expected. If as widely divergent results can be reached by competent engineers dealing with the same subject matter, as have here been reached, then the most that can be said is that the value of engineering aid to rate fixing is much over-estimated, or that one or the other engineer, where such widely different results are obtained, is mentally dishonest. I do not mean by this a reflection upon Mr. Woodbridge, the engineer who made the physical appraisal in this case, but my reflection is upon the method and those responsible for it. What the commission would like to know is the sum of money upon which it ought to allow an earning in any case, and it will serve no good purpose and will be merely a waste of time for utilities to present an exaggerated statement with the hope that this commission may follow a practice, too prevalent in the past, of splitting the difference between such estimate and some other which is perhaps lower. This commission, however, should have no desire whatsoever in the matter, either that the basis for rate fixing be large or small. It should merely desire the facts, and when theories must be applied to facts, only those theories which give to the utility and the patrons what ought to be accorded should be followed.

The profit of 2½ per cent which defendant asks, introduces another intangible which if capitalized at 8 per cent would amount to something in excess of $82,000 and this brings out rather forcibly the fact that any return, on an investment in or value of a property, over and above the "cost of money" is an allowance which to some extent at least provides for those necessary expenditures incidental to the construction of a plant and the creation of a going concern which would not appear in any subsequent appraisal of the physical properties. The natural or apparent hazard of the business is usually reflected in the cost of money itself which fact is at once made apparent by a comparison between that cost where a material hazard may be assumed to exist as in the present case where it is said to be 6½ per cent and the cost in cases of minimum hazard as with government bonds. The hazard, actual or assumed, incidental to the creation and transaction of any business, from the investor's point of view, and which view eventually regulates the price or cost of money, may be the relative security of earning power as compared with some other investment or may depend primarily upon the relative security of the principal. In any event the immediate effect of the element of hazard is apparent in the cost of money. The security of earning power is largely safeguarded by the measure of protection from competition which the state, through this commission, can give. The security of the principal is obviously dependent at any time upon the relation which is maintained between value of the properties and the total amount of the securities issued thereupon.

Engineers for defendant contend that the company should be allowed a return of 10 per cent on the "invested capital" over and above operating expenses (including ordinary maintenance) and an allowance for depreciation. This 10 per cent is made up by figuring the average cost of money at 6½ per cent and adding to this percentage 2½ per cent for "profit" and 1 per cent for "obsolescence of equipment." The term "invested capital," as used by the engineers, appears, in so far as the physical plant is concerned, to have no reference to original investment as no evidence was introduced bearing on that subject, but in estimating the proper amount to be hereafter allowed for depreciation the original investment theory has evidently been adopted. Notwithstanding the fact that defendant admits that it has in its possession the books and records of the predecessor companies since about the time the gas plant and system was constructed, the company's engineers and officials chose to estimate "invested capital" on the basis of what a duplicate plant would cost new, including greatly appreciated land values and alleged intangible values, amounting, as I have hereinbefore mentioned, to $65,800 or almost 50 per cent of the full estimated cost to reproduce the physical plant. To my mind it is wholly illogical, after ignoring actual historical costs to attempt to arrive at invested capital upon a hypothetical basis not only in regard to the unit costs themselves but in the actual process by which the property was created. Having once discarded the original cost or investment basis, and having laid claim to all appreciated values, it would appear that the only alternative left would be to estimate present value upon the depreciated reproduction theory unless we are to depend entirely upon the amount of stocks and bonds outstanding, which latter basis would be obviously unfair under the circumstances of this particular case.

The ratio between the estimated cost to reproduce new the gas properties of defendant in Monterey and Pacific Grove, exclusive of real estate, and the depreciated reproduction cost or so-called "present value" of those properties, as shown in the valuation report prepared for the defendant company by Ford, Bacon & Davis, is 75.16 per cent as of August 31, 1912. Upon the same theory, assuming that this ratio of 75.16 per cent is correct and that it remained the same on December 31, 1913, the present depreciated value of the property, as of that date, upon the basis of Mr. Kelley's estimate of the cost to reproduce the plant new corrected to allow for the tangible and intangible additions already referred to and disregarding for the moment the corresponding deductions, would be $96,237.97.

The opinion concludes with an analysis and criticism of the detailed operating expenses and revenue from gas sales during 1913, together with a recommendation that a station meter be installed at the Monterey plant and suitable facilities be provided for determining the quality of gas, the accuracy of customers' meters and the distribution pressure.

SEATTLE LIGHTING REPORT.

Superintendent J. D. Ross has compiled a comprehensive biennial report of the lighting department of the City of Seattle, Wash., for the years 1912 and 1913. A condensed history and description of the system is given to supplement the extended one published two years ago, and much space is devoted to the developments of the past two years. A valuable feature is the schedule of costs of construction work and the synopsis of work done on electric cooking and heating.

The financial statement shows assets of $4,773,-932.62, bonded indebtedness of $3,240,000, accounts payable and interest due of $304,375.22, depreciation and sinking funds $59,599.92, capital investment $359,-857.26 and surplus revenues for 1908-1913 absorbed by extensions, new construction, etc., $810,100.21.

Revenues totalled $910,477.35 of which $245,089.99 was derived from sale of current for municipal service and $659,673.08 from current sales for business, residence and power. Operating expenses for 26,306,861 kw.-hrs. delivered were $437,140.03, additions and improvements totalled $868,488.75 and revenue surplus after providing for operation, maintenance, reconstruction, interest, lost accounts and depreciation was $274,657.68.

Over 29,000 customers are being served at a 6-cent rate with 50-cent monthly minimum bill.

Most of the expenditures for additions and improvements were on the new concrete dam, which will be completed to a height of 180 ft. this year, and on the city substations.

Electrical Heating.

During the past two years several experiments have been carried on by the lighting department to determine the practicability of using electricity for heating the home. For this purpose several houses have been fitted up by their owners with electric heaters, both of the direct radiation type and the type used in connection with hot water radiators. The lighting department connected these houses to its mains, made a special rate for current and kept complete records of the temperatures maintained in the house and the amount of current used.

The first house equipped is of concrete construction with solid 8½ in. walls, and contains five rooms, having a total floor area of 418 sq. ft., a cubic capacity of 3252 cu. ft., an outside wall area of 491 sq. ft., and a window area of 127 sq. ft. In this house were installed five electric heaters of the direct radiation type, of which three were 2 kw. and the other two had a capacity of 1½ and 0.6 kw. respectively. Recording meters were placed in the service to measure the current; and the daily maximum, average and minimum temperatures, both outside and inside the house, were observed and recorded. The total consumption for the year amounted to 10,250 kw.hours, running from 2430 kw. hours in December to 20 kw. hours in July. An average temperature of 70 degrees was maintained inside the house, and the minimum at night was kept above 58 degrees. The mean outside temperature was 51 degrees and the minimum, 26 degrees.

In this house no discrimination was made with regard to the time of day when the current was used. Another method of using electric heat is to install an electric hot water heater to replace, or to be used in conjunction with, the regulation boiler on a hot water heating system. In theory this method is less efficient than when direct radiating heaters are used, on account of a slight loss in the piping of the hot water system. An advantage which more than offsets this slight loss is that a hot water storage tank may be installed which will supply heat to the house for several hours after the current is turned off, and in this way the supply of current may be cut off during the hours of maximum demand on the lighting plant for current for lighting purposes. With this scheme of electric heating, enough customers can be supplied with current for heating purposes to exhaust the full capacity of the present distribution system without any further installation whatever except for the mere service wires from the pole to the house, since the heaters will be cut off during the hours when light is used. There are now four houses equipped with the hot water system of electric heating on the city's lines. Experience shows that 1 kw. of heater capacity will supply 20 sq. ft. of radiation and will require 20 gallons of storage tank capacity to supply heat during the lighting peak in winter. The cost of making the installation, which is borne by the customer, will run from $10 to $25 per kilowatt capacity of the heater, depending on the size and layout of the house. This expense includes merely the wiring and installation of the electric heater and the cost of the heater itself. The records show that in one house of frame construction having 200 ft. of radiation supplying four rooms with outside wall area of 846 sq. ft. and window area of 201 sq. ft. and cubic contents of 7290 cu. ft., the monthly consumption of current during the winter months averages 3000 kw. hours, with a temperature maintained in the house at 68 to 70 degrees, and the average monthly consumption for the entire year will to about 13,000 kw. hours.

To sum up the results of all the heating experiments to date: Electrical heating for homes is perfectly feasible and is the most convenient and cleanest method. Despite the fact that heaters of 100 per cent efficiency are used, the amount of current needed makes the expense at present rates several times that for heating with coal. One pound of coal contains as much heat as three kw. hours in electricity, and with coal at $6 per ton and current at 2c per kw. hour, the coal costs 0.3c as against 6c for the current, a ratio of 20 to 1 in favor of the coal. This is partially offset by the fact that all of the heat of the current is utilized, while from 30 to 80 per cent of the heat of the coal is wasted. Compared on a basis of cost, electricity at one-half cent per kw. hour is from 25 per cent to 40 per cent higher than coal at $6 per ton. By developing water power in large units and supplying heating during "off-peak" hours, it will probably be possible in the future to supply current at rates that will make its use for heating within the reach of the average income.

While electric heating must be regarded as a luxury at the present rates, this is not true of electric cooking. Scores of people in Seattle depend upon electricity altogether for cooking and uniformly agree that it is the most convenient, safest and cleanest method and no more expensive than any other method. The lighting department is encouraging the use of

electric current for cooking and has made a rate of 3c per kw. hour for this class of service. The engineering staff of the department has collected data on electric cooking and heating and is ready to assist customers who wish to use current for this purpose. An average of all the bills rendered during the past two years shows that the average monthly bill for current for electric cooking is $3.03.

ANTIOCH RATE CASE.

In a decision covering seventy-seven pages and embracing the results of many months of work on the part of the Railroad Commission and the engineers of the Pacific Gas and Electric Company, the Railroad Commission of California has established rates which the Pacific Gas and Electric Company may charge in the town of Antioch, and at the same time has established a cost basis for the production of electric energy, which will make it a comparatively easy matter to fix rates in any city or community where this company operates.

The decision segregates rate-making into two distinct divisions, based on the cost of production and the cost of distribution. As determined by the Commission, the cost of generating electricity with the Pacific Gas and Electric Company's system and delivering it to the limits of any city is 7.312 mills per kilowatt hour. With this figure as a basis, the Commission has only to determine the cost of distribution in any community in order to establish rates for that community. In Antioch a graduated scale, ranging from 7 cents to 3 cents per kilowatt hour, is established.

The decision grew out of a comparatively unimportant rate inquiry. Rates to be charged in Antioch were under consideration, and the Commission seized the opportunity for making a thorough investigation of the entire generating and transmission system of the company.

The company contended that it was entitled to a return on the basis of the cost to reproduce its plant new, plus an allowance for going concern value. In the main, the decision agrees with this contention, but declares that it will hold good only when the corporation's plant has been kept up to 100 per cent efficiency, and a proper depreciation fund has been established.

The constant 7.312 mills per kilowatt hour is arrived at by taking the reproduction value of the company's generating and transmission plants in 1911, when they were definitely known, adding the value of permanent improvements since then and writing off depreciation. With this figure known, the Commission allows the company 8 per cent interest, although the company itself asked for 8½, allowing for maintenance and depreciation and allows the operating cost.

How Rate Was Fixed.

With the total of energy to be generated closely estimated, the cost per kilowatt is obtained by simple division. The figures from which the 7.312 miles was obtained are:

Value of hydroelectric plants	$14,675,174.26
Value of steam-electric plants	5,455,282.16
Value of transmission system	5,930,529.10
Total	$26,060,985.52

Annual Operation, 1914.

Interest at 8 per cent, depreciation and maintenance	$ 2,408,377.66
Operating cost	1,171,978.90
Power purchased	824,200.00
Total	$ 4,404,556.56

It is estimated that the company will produce 602,360,837 kilowatts of energy. To meet the cost of generating it and transmitting it to cities for distribution, its rate is thus placed at 7.312 mills.

As to the claim as a "going concern," the Commission contented itself with repeating the well-known decision of Judge Van Fleet, to the effect that rates must be fixed on a basis of money wisely and honestly expended. "The best evidence of what should be allowed for developing the business, is the amount of money which has actually been expended for that business."

"The effects of abnormal conditions, bad management, poor judgment, the lack of ordinary care and foresight must be borne by the utility and not by the public.

"It would be far wiser for the utilities of the State, instead of trying to establish a depreciation fund, to deal with the Commission with absolute frankness, and after assisting the Commission to ascertain the fact, to ask frankly for the margin in the rate of return which will enable them to earn a profit in excess of the actual necessary expenses.

"The rate of return should be such a rate as is high enough to secure funds for the development of the business, and in reaching its conclusions on this point the Commission should be liberal in its attitude."

Rates Fixed for Antioch.

Following its newly formed policy, the Commission fixed rates for Antioch as follows:

First 20 kilowatt-hours, per month	7c per kw.-hr.
Next 980 kilowatt-hours, per month	4c per kw.-hr.
Over 1000 kilowat -hours, per month	3c per kw.-hr.

The top rate for lighting is cut from 8 cents. The new rate will save the town about $570 a year for street lighting, in addition to the saving to private citizens.

Timber preservation by chemical treatment made notable progress during 1913, according to a report recently issued by the American Wood Preservers' Association in co-operation with the forest service of the department of agriculture. The report states that 93 wood preserving plants in 1913 consumed over 108 million gallons of creosote oil, 26 million pounds of dry zinc chloride, and nearly 4 million gallons of other liquid preservatives. With these the plants treated over 153 million cu. ft. of timber, or about 23 per cent more than in 1912. The output from additional plants unrecorded would increase the totals given. In Great Britain and most of the European countries practically every wooden cross-tie and telephone or telegraph pole receives preservative treatment. In the United States less than 30 per cent of the 135 million cross-ties annually consumed are treated, and the proper treatment of an annual consumption of 4 million poles may be said to have scarcely commenced.

UTAH COMPANY LOSES GOVERNMENT SUIT.

The Utah Light & Railway Company is enjoined in a decree handed down by Judge John A. Marshall in the United States District Court, from occupying government land with portions of its hydroelectric power works, pipe line, diverting dam and power house in Big Cottonwood canyon. The decree was based on a decision of the circuit court of appeals in a similar case, that of the United States against the Utah Power & Light Company, reported in 209 Fed. 554. The bill of complaint in the present case was filed in the United States District Court in Salt Lake City by Attorney General Geo. B. Wickersham, through Hiram E. Booth, then United States District Attorney, September 23, 1912, in which the defendant company was charged with operating its electric power plant upon government lands without first having secured a permit from the secretary of the interior for the operation of the plant. This is a companion case to U. S. vs. Utah Power & Light Company, the decision of which by the circuit court of appeals is reported in 209 Fed. 554. The defendant claims here, as was contended in that case, that its right to its reservoir and canals vested under section 2339 of the revised statutes of the United States, and that subsequent legislation does not affect it.

The decree, as handed down by Judge Marshall is in full as follows:

In the case cited, it was determined that the act of May 14, 1896 (29 St. 120) superseded section 2339 with respect to such rights over public lands for electric power purposes, the beneficial use to which the defendant devotes its water appropriation; that after the passage of that act no right of way could be obtained except pursuant to a permit from the Secretary of the Interior. It is admitted that the defendant has not obtained such a permit, and the question to be determined, therefore, is whether the defendant's right had vested prior to May 14, 1896. These rights were initiated by two notices of appropriation, the one on May 13, 1893, and the other on June 5, 1894, but the reservoir and canals were not completed and water was not in fact diverted until after May 14, 1896. There is a concurrence of authority that the right to an easement for a ditch or canal over the public land, claimed under section 2339, only vests on the completion of the work, but that when so completed, as between rival claimants, the title will relate back to the commencement of the work, or notice of appropriation, provided the work was prosecuted with due diligence. This rule of relation, however, has no application against the United States. As to it, prior to the final completion, the appropriator is acting under a revocable license, and cannot complain if the license be withdrawn, even if, as in the instant case, he has expended a large amount of money in expectation of finally obtaining title.

U. S. v. Rickey Land & Cattle Company, 164 Fed. 496; it would then seem that when the decision of the circuit court of appeals is applied to this case a decree for the plaintiff must follow.

It may, with force be argued that a statute must be construed as intended to operate prospectively and not retrospectively, if such construction does not clearly violate its language, and that the statute of May 14, 1896, should be held to apply only to future permits; and that those who have already commenced work pursuant to the implied license of section 2339, so far as appropriations of water for electric power purposes are concerned; there seems to be no injustice in substituting for an indefined implied license a defined express license, and the act can be properly construed prospectively as providing in effect that no title to an easement should thereafter vest. The object of the act, as determined by the court of appeals, was to substitute the permit system for the vested easement system, if an exception of inchoate rights had been intended it would doubtless have been expressed.

It is suggested as the Secretary of the Interior did not promulgate regulations under the act of May 14, 1896, until after the diversion of the water was completed that the defendant's rights are saved. I do not think so. The question, is, what was the intent of Congress in enacting the statute of May 14, 1896? The subsequent acts of the Secretary of the Interior can cast no light on this intent. If the intent was to terminate the system of vested easements over the public lands for canals for power purposes, and to authorize the Secretary of the Interior to issue revocable permits thereafter, then no delay by the secretary in issuing a permit can confer vested rights.

The injunction sought by the plaintiff will issue with respect to that part of the defendant's works which are situated on the lands of the United States.

The decree is dated Salt Lake City, Utah, June 29, 1914.

ELECTRICAL IRRIGATION IN UTAH.

For the purpose of determining the feasibility of irrigated land in the vicinity of Willard by electrically operated pumps from deep wells, the Utah Power & Light Company have recently installed a demonstration well on the farm of A. A. Lemon at North Willard. A fairly good flow of water was struck at 46 ft. depth and a hand pump demonstrated that the well had considerable capacity. An electrically operated pump was later installed and a flow of 75 gallons per minute was obtained without in any way reducing the appreciable supply of the well. The power company believes that a considerable acreage in the vicinity of Willard which does not now have a water right from the gravity ditches will be reclaimed by the installation of electrically operated pumps.

At Brigham City many valuable peach orchards were grown and are now cultivated by means of water obtained from electrically pumped wells. The municipal electric plant at Brigham City has established a low rate for power believing that the municipality would profit more from the highly productive orchards thus created than by charging a prohibitive rate for power which would prevent its use.

The Utah Power & Light Company has purchased the power plant formerly owned by the Ogden Rapid Transit interests at Brigham City and this plant is now idle owing to a considerable surplus of power. It is expected however that if the Utah Power & Light Company can develop a sufficient market for its power for irrigation purposes in this vicinity, that it will resume the operation of the power plant.

Large pumping plants have already been installed on the shores of the Utah Lake to supply the bench lands and also to maintain the normal flow of the Jordan River throughout the summer, thus providing a constant supply for the irrigation canals in Salt Lake Valley.

The pumping idea has found further application in the Cache Valley in northern Utah and in certain southern Idaho districts, where valuable lands have hitherto failed to reach their utmost productiveness because of the cost of erecting the dams and other works that are necessary in irrigation by gravity, or because of a shortage of water in the late summer. The Utah Power & Light Company has been active in the establishment of small pumping plants.

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Mentally Dishonest Engineers

Fact, law and judgment are the tripod upon which valuation is supported. When the property to be valued is a public utility designed, built and operated by engineers it is necessary to look to the engineers for fact, to the courts for law and the commissions for judgment. Anything which creates the least suspicion concerning the integrity of any one of these factors should be carefully investigated. Consequently the opinion of the Railroad Commission of California regarding the complaint of the City of Monterey that the gas rates of the Coast Valleys Gas & Electric Company were unjust is worthy of careful study.

The opinion of Commissioner J. M. Eshleman, as printed elsewhere in these columns, gives evidence to show that neither the stock and bond issues nor past expenditures were of assistance in arriving at a proper valuation. The estimate of the commission's engineer as to the cost to reproduce the plant new was less than half that of the firm employed by the company, especially as regards intangible values. The commissioner finds several inconsistencies in the methods of estimating and wide divergencies in results. These inconsistencies he characterizes as "mental dishonesty" and these divergencies as proof that "the value of engineering aid to rate-fixing is much over-estimated."

While it is neither the purpose nor the province of this journal to defend the valuation methods employed, and while one such opinion does not make law nor even represent good judgment, attention should be called to certain facts with which lawyers are not familiar.

There is no profession which must adhere to facts more closely than engineering. Fact and truth are inseparable. As the poet says, "Facts are the stones heaped about the mouth of the well in whose depth truth reflects the sky." Engineering ethics are insistent that expert engineering opinion cannot be colored to favor the case of any client.

Valuation of public utility undertakings for rate-fixing purposes is a matter of such recent origin that its rules and methods have not yet been standardized in theory or practice. Great difference of opinion exists as to what should be included. Some precedent exists for every item which does not agree with the opinion of the commissioner, and an equally authoritative contradiction can be found for many of his own views. Finality can be given to many of these controversies only by court rulings. Even the rulings of the lower courts are contradictory and can be taken merely as indicative of the general theory which valuations must follow in order to make them valid.

Because engineers are rarely able to predetermine the cost of construction, with all the possible contingencies which may arise, is no reason why they should cease their endeavors. It is not humanly possible to construct a plant by the substitution of hind-

sight for foresight. And because one engineer's appraisal of past work coincides no more nearly with another's than does one estimate of future work match another is no reason why one or the other should be accused of dishonesty, mental or otherwise.

Inconsistency and dishonesty are not synonyms. The law is a maze of contradictions, all judgment is fallible, and the blame attaches as much to the courts and the commissions as to the engineers for any inconsistency which may have roused the righteous wrath of the commission.

Anger is sometimes a most valuable thing, especially as the finest expression of a personality in action. But it may also be an evidence of a lack of self control.

Most public utilities fully understand "that under modern conditions they are literally at the mercy of the state" and are doing everything in their power to be worthy of that mercy. Under modern conditions, also, the quality of mercy is strained through the individual official representing the state control. Such officials should realize that meticulous supervision permitting a minimum return on capital invested can counteract any stabilizing influence which can be given the securities. These dangers can be avoided by a broad-minded policy fostering the needs of the utilities as well as the public.

Types of Management

Business can be graphically represented as a vector diagram of forces. The equilibrium triangle of business energy is made up of the passive forces of nature, the active forces of men and the resultant force of capital. The principles of engineering, the art of directing forces, are now being applied to the scientific management of business.

Some of these principles have been outlined in the series of articles on "The Three Types of Management," which has recently been published in these columns. But considering successful management as essentially a form of human engineering which directs the forces of nature, labor and money to most effectively gain profits, it is possible to classify several other types in the science of management. These several groups are often only different names for the same methods, having been developed to meet the peculiar requirements of each kind of business.

Mr. Lewis considers management from the standpoint of the accountant who is liable to treat business as a study of forms rather than of forces, static instead of kinetic. He shows how the strenuous manager of the old school did his work by rule-of-thumb and cut-and-try; he tells how the systematic manager fell into a rut in finding out what had already happened, and he compares both with the efficient manager who has adopted the good features and rejected the bad from the older methods. However, even an efficient manager is not effective unless his efforts are properly directed. The efficiency of the accountant is not equal to the effectiveness of the engineer.

The executive, in the consideration of management, usually lays more stress upon means of counsel and methods of carrying out orders. From this viewpoint management has been classified into the military and the staff types. The former is a one-man guidance, the latter an administration by a staff of specialists. One of the fundamental differences between these two types is shown in the method of advancing men to higher positions. Seniority counts in the military type, ability in the staff organization. Surely the word manage is not derived from the mere addition of age to a man, any more than is a personage created by adding age to a person.

The operator, who considers the control of the work of prime importance, prefers a classification into the departmental or the divisional type. In the one, control of operations is centralized; in the other the responsibilities of operations are placed upon the local division superintendents. The latter type has been highly developed to meet the needs of railroading and conforms closely to the organization of many great hydroelectric power systems. But for smaller companies most industrial engineers agree that the departmental type is preferable, as the control is simpler and the available talent more efficiently used.

The engineer, figuring on the control of forces, classifies an organization as either undisciplined, disciplined or functional. In the undisciplined organization, where verbal instructions are given, the forces are not under proper control nor are they co-ordinated. In the disciplined organization written instructions at least tell the workers what to do, though task standards are lacking. Discipline is not punishment but teaching, a training for prompt and effective action. A man being disciplined is literally one who is learning. The manager is the teacher, the leader. He should not do, but teach other people to do. Teaching is thus the fundamental function of management.

Functional management, as originally developed by Dr. F. W. Taylor, past president of the American Society of Mechanical Engineers, takes its name from the fact that each man has as few functions as possible to perform. Different foremen instruct the worker what, how, why and when to do. Standards are set and workers intelligently selected in accordance with the requirements of the task, thus permitting the highest efficiency of endeavor. Definite preliminary planning is the chief characteristic of this method, in which unity of purpose, co-operation for a single result, is the keynote.

The engineer is a man of vision, a dreamer who makes his dream a reality by first planning his work and then working his plan. The engineer who understands the principles of accounting and business administration, should be the manager of the great industrial enterprises of the future, for such training more nearly approximates directed efficiency.

While many of these principles seem theoretical the manager whose activity is not limited by the inertia of habit will recognize their truth. Just as the luxuries of yesterday have become the necessities of today, so will the theory of today become the practice of tomorrow.

PERSONALS

John S. Eastwood, consulting civil engineer at San Francisco, is at Sacramento, Cal., on dam business.

A. E. Griswold, of the A. G. Electric Company, Portland, is expected to arrive in San Francisco in the near future.

A. C. Ayres of the Portland Gas & Coke Company, was at Spokane, Wash., from Portland, Ore., during the past week.

F. S. Pratt, vice-president of the Stone & Webster Management Company, is making a tour of Alaska with his family.

F. A. Richards, of Pierson, Roeding & Company, San Francisco, left for a business trip through the northwest during the week.

J. M. Hollas has been appointed agent light and power department, B. C. Electric Railway Company Limited, at Chilliwack, B. C.

L. F. Youdell, manager of the Electric Machinery & Equipment Company of Stockton, Cal., spent the past week in San Francisco.

C. S. Gauntlett, of Pierson, Roeding & Company, San Francisco, left during the week for a business trip through Southern California.

A. E. Poingdestre, manager of the Pacific Gas & Electric Company, Marysville, was a visitor in San Francisco during the week.

H. V. Carter, president of Pacific States Electric Company, San Francisco, is making an extended trip through Southern California.

G. H. Riddock, secretary Bauer Fixture Company, San Francisco, has been elected a member of the Illuminating Engineering Society.

J. Montgomery, contract agent of the Western Canada Power Company at Vancouver, B. C., has returned from an extended summer vacation.

W. L. Goodwin, vice-president of Pacific States Electric Company, San Francisco, returned from a trip to Sacramento the first part of the week.

Geo. C. Campbell, general manager of the Truckee River General Electric Company, Reno, spent a portion of the week on a business trip to San Francisco.

B. H. Hansen, representative of the A. G. Electric Company, San Francisco, recently returned from a business trip to San Diego and Southern California.

Louis C. La Mont, representative of the Westinghouse Electric & Manufacturing Company at Butte, Montana, has returned to Butte from a visit to Seattle.

H. R. Noack, president of Pierson, Roeding & Company, San Francisco, is on a several days' trip to the mountain regions of Plumas County, California.

L. A. S. Woods, special representative of the Detail and Supply Department, Westinghouse Electric & Manufacturing Company, Pittsburgh, spent last week in San Francisco.

E. L. Barnett, chief electrician for the Fort Bragg Electric Company and Union Lumber Company at Fort Bragg, Cal., Francisco, has been elected a member of the Illuminating Society.

Francis Blossom, a member of the firm of Sanderson & Porter of New York and San Francisco, who has been in San Francisco for several weeks past, has left for his home in New York.

W. B. Hall, Pacific Coast representative of Pass & Seymour Company, San Francisco, who has been on an extended Eastern trip is expected home shortly, visiting the Northwest enroute.

Fred S. Mechling, manager of the Nevada-California Power Company, Goldfield, spent a few days in San Francisco during the week enroute to the north, where he intends spending his vacation period.

C. R. Martin has recently come to San Francisco from Milwaukee to join the Pacific Coast sales organization of the Allis-Chalmers Manufacturing Company, making a specialty of hydroelectric installations.

E. K. Patton, Western manager of the Bryant Electric Company, Chicago, arrived in San Francisco Tuesday on a business trip and expects to spend a week or ten days in that section of the state.

K. A. Schaller, railway expert with the Seattle office of the Westinghouse Electric & Manufacturing Company, recently returned to Seattle from an extended trip through Minnesota, Montana, Idaho and eastern Washington.

O. O. Calderhead, statistician of the State of Washington public service commission, reports that no accidents occurred in that State during 1913 fatal to passengers on electric roads, but reports ten accidents fatal to employees.

W. T. Woodroofe, who recently resigned as superintendent of the Edmonton, Alta., municipal street railway system, is now with the Edmonton Interurban Railway superintending the installation of the first section of the new system.

F. D. Nims, chief electrical engineer Western Canada Power Company, was recently elected chairman of the Vancouver Section A. I. E. E.; **K. A. Auty,** chief sales department representative B. C. Electric Railway Company at Vancouver, B. C., was elected secretary.

H. A. Johnson has accepted a position with the Utah Light & Railway. Mr. Johnson is a graduate of the University of Utah in 1912. After graduating he entered the apprenticeship course of the General Electric Company at Schenectady. His home is in Ogden, Utah.

H. E. Plank, agent in charge of Seattle office of the General Electric Company, has returned from a trip through southeastern Alaska, where at Treadwell he closed a contract with the Alaska Treadwell Gold Mining Company for electrical equipment, including a 2000 kw. turbine, switchboard and motors.

Olive Huppert, formerly demonstrator for the Utah Light & Railway Company at Salt Lake City, has resigned to accept a position with the Elko-Lamoille Power Company of Elko, Nevada, as demonstrator. **B. J. McBride,** manager of the company, was in Salt Lake City last week arranging for the opening up of the company's new electric shop and while here Mr. McBride engaged the services of Mrs. Huppert.

H. N. Lauritzen, Pacific Coast manager for the Holophane Works of the General Electric Company, and **J. O. Presbrey,** traveling representative, have left San Francisco and Salt Lake City, respectively, to attend the convention of Holophane salesmen to be held at Cleveland, commencing July 20th. The convention meetings will be held at Nela Park, where a tented city has been erected by the various association lamp companies for accommodating their conventions.

Helen L. Bartlett, formerly teacher of cooking in the Salt Lake High School, has accepted a position as demonstrator in the electric shop with the Utah Light & Railway at Salt Lake City. Miss Bartlett has made a careful study of the application of electricity to cooking purposes and has written several articles on the subject. It was largely through her recommendation that the board of education of Salt Lake City decided to install electric ranges and cooking appliances in the cafeteria of the new $100,000 East Side High School recently completed, and also to install electric cooking equipment in the demonstration department of the high school.

J. B. Rannie, who has been connected with the B. C. Electric Railway at Vancouver, B. C., for nearly 25 years, resigned on July 1st. Mr. Rannie's career with the company dates from September, 1889, his first work being the reconstruction of some cars which had been purchased with the idea of horse operation, this in the meantime having been changed to electrical. He then served as motorman and conductor on the city lines, finally choosing the front platform as his permanent position. During his service with the company he has seen the system wonderfully extended. After serving as motorman for a number of years Mr. Rannie was in 1900 appointed traffic superintendent of the Vancouver city lines which post he held until 1911, when he was appointed traffic agent, a position which he filled until the presentation of his resignation. Mr. Rannie will leave the field of electric railway activities to engage in agricultural pursuits at Chilliwack, B. C., where he has purchased a ranch.

MEETING NOTICES.

Electrical Vehicle Association.

The San Francisco Section of the Electric Vehicle Association of America held an enthusiastic meeting last Wednesday and was addressed by Mr. S. Henderson of the transportation section of the Panama-Pacific Exposition. Plans were discussed for participation by the electrical vehicle people in the dedication ceremonies of the automobile section at the Exposition July 15 and ways and means adopted looking toward a strong representation by the electric vehicle in the automobile parade on the same date. Messrs. Cutting, Logan, Perin, Hatton and Cosby were apppointed a committee on parade arrangements.

Electric Power Club.

The Electric Power Club held its annual meeting at Hot Springs, Va., on June 8th, 9th and 10th. The organization whose membership is drawn from manufacturers of electric motors and generators has been engaged for the past three years in the important work of standardizing the ratings of electrical machinery, defining the terms and nomenclature used, and establishing standards in many mechanical details on which uniformity of practice is desirable, such as pulley sizes, speeds, shaft diameters, keyways, etc.

One of the most important matters to come before the meeting was the subject of Single Rating and a paper on this subject was read by Mr. Chas. Robbins. In the past electrical machinery has been rated both in terms of load and overload and the relations between the two, the time rating for which the overload was specified and the temperature allowed have all been continually subject to revision, requiring frequent redesign in order to meet the changing specification requirements. Single rating is the expression used to define a method of rating electrical machinery which, with the maximum temperature to which different classes of insulation can safely be subjected definitely known and fixed, rates the motor in terms of a single load rating coupled with a single time rating.

The tendency both in this country and abroad is towards the single rating method. It has already been adopted by the International Electro Technical Commission and is under consideration by the A. I. E. E. All special application motors used in this country are already so rated, such as crane, elevator, machine tool, railway motors, etc. Although there is no condition of load or service which can not be properly expressed in and interpreted by the single rating method, the bulk of general purpose motors are now sold with a time overload rating in addition to the nominal rating and it was recognized that any immediate change of practice would cause considerable confusion in the trade. The members of the Electric Power Club unanimously adopted a resolution expressing entire concurrence in the principle of single rating and instructing the different committees to constructively work towards the single rating method in all standardization work during the coming year. Recognizing the valuable work that the A. I. E. E. is also doing in this same direction, the committees were instructed to work in thorough co-operation with that body.

Prof. Francis B. Crocker, president of the club, recently submitted a paper to the members giving his views on the proper line of demarkation between the standardization work of various associations whose interests are more or loss closely allied. There was considerable discussion of this paper at the meeting and uniform approval of the views given by Prof. Crocker. Applying his ideas to the standardization of electrical machinery, the work of the A. I. E. E. would be in general that of establishing broad engineering and technical limits within which such machinery should be designed, but, provided these limits were not exceeded, the exact basis of commercial rating to be used should properly be left to such an organization as the Electric Power Club, as the manufacturers of electrical machinery are naturally more familiar with any limitations in manufacture which might exist as well as with the necessity of adopting for certain classes of apparatus greater conservatism in the basis of rating than is required where the conditions of load and service can be definitely determined.

The Standardization Committee through its sub-committees recommended a number of standards which were adopted at this meeting. In addition to 115 and 230 volts previously approved, 550 volts was adopted as a standard voltage for direct current motors. Similarly 600 volts was adopted as a standard direct current generator voltage in addition to 125 and 250 volts. The standard voltages for alternating current generators were revised to 240, 480, 600 and 2400 volts. The standards previously adopted for alternating current motors had been confined to polyphase motors and at this meeting standard voltage ratings, temperature ratings, and name plate markings were adopted for single-phase motors.

The following table gives the standards previously adopted for the diameter and face of pulleys for motors of different capacity and speed. The shaft diameter, shaft length and keyway size shown in this table represent the recommendation of the committee on this subject and have been submitted to the manufacturers for careful consideration before adoption.

Standard Pulley Sizes.

Motor Rating in H. P.				Pulley.		Shaft.		Keyway.	
1800 r.p.m.	1200 r.p.m.	900 r.p.m.	600 r.p.m.	Dia.	Face	Dia.	Length.	Wdth.	Dpth.
2	1	..	..	4	3	15/16	3	¼	⅛
3	2	..	..	4	3	1	3½	....	....
5	3	..	..	5	4	1 3/16	4	5/16	5/32
7½	5	..	..	6	4	1 3/16	5	⅜	3/16
10	7½	5	..	7	5	1 9/16	5½	....	....
15	10	7½	..	8	6	1⅞	5½	½	¼
20	15	10	..	9	7	2	6	....	....
25	....	..	..	10	7	2⅛	6½	....	....
30	20	15	..	10	8	2¼	7	....	....
40	30	20	15	11	10	2⅜	7½	....	....
50	40	30	20	12	11	2½	8	⅝	5/16
..	50	40	30	13	12	2¾	8½	....	....
..	75	50	40	14	12	3	9½	¾	⅜
..	100	75	50	16	13	3¼	10½	....	....

All standards as adopted are printed in the Book of Standards of the Electric Power Club. This book contains much valuable information on standard ratings of electrical machinery, speeds, guarantees, nomenclature, etc. Copies can be obtained from Mr. C. H. Roth, the Secretary, at 1410 West Adams street, Chicago, Ill.

At the close of the meeting Prof. Francis B. Crocker was re-elected president. Prof. Crocker has been closely associated with both the technical and commercial phases of the electrical industry from its inception and was chairman of the first Standardization Committee of the A. I. E. E. He has done valuable work in connection with the technical standardization originated by that body and is well qualified both from experience and association to lead the work of industrial standardization which is being undertaken by the Electric Power Club.

NEWS OF THE CALIFORNIA RAILROAD COMMISSION.

The San Diego Electric Railroad Company filed an application asking for authority to create a bonded indebtedness of $10,000,000. The bonds which the company proposes to issue will be known as General First Lien 5 per cent Sinking Fund 40 year gold bonds, and will be secured by a trust deed of all the railway company's property. The company gives as its reason for creating this indebtedness the necessity for improvement and expansion due to the growth of the community and the expected increase in business which will result from the Exposition to be held in San Diego in 1915.

The commission has rendered a decision authorizing the Southern California Edison Company to purchase 1060 shares of the preferred stock of the Long Beach Consolidated Gas Company at $80 per share. The Long Beach Consolidated Gas Company has issued 850 shares of preferred stock all of which are owned by the Southern California Edison Company, 5552 shares out of 6757 of its common stock are also owned by the Southern California Edison Company.

The Commission has rendered a decision authorizing the Southern California Edison Company to sell its electric distributing system in San Fernando, Los Angeles County, to the Pacific Light & Power Corporation. The purchase price will be $9,448.

The Modesto Gas Light Coal & Coke Company, operating in Modesto, Stanislaus County, has filed an application with the commission, asking authority to renew for one year two promissory notes amounting to $42,778 in favor of Frank A. Cressey.

The commission has rendered a decision in the complaint brought by the city of Monterey against the Coast Valleys Gas & Electric Company. Monterey is one of the cities that has vested its control over public utilities in the commission. The Coast Valleys Gas & Electric Company was organized in 1912 with $5,000,000 capital stock and authorized bonded indebtedness of $10,000,000. The city charged that the gas company's rates were unreasonable. The gas company denied this and asked the commission to fix rates which would allow a return of 10 per cent on the full estimated reproduction cost of its property. The rates as finally determined by the commission will reduce the top rate charged by the gas company from $1.50 to $1.30. It is estimated that the rates as established by the railroad commission will allow the gas company a return of 8 per cent on the commission's valuation of the property.

The commission has rendered a decision authorizing the Pacific Gas & Electric Company to issue bonds as follows: 1—$5,000,000 par value general and refunding mortgage gold bonds. The commission to determine in a supplemental order the minimum price at which they are to be sold. 2—$12,500,000 par value first preferred stock at not less than $82.50 per share and as much additional as may be necessary to exchange for original preferred stock after July 1, 1916, at the rate of 1025 shares of first preferred stock in exchange for one share of original preferred stock up to a maximum of $10,000,000. 3—$1,159,800 par value of common stock for the reimbursement of moneys expended for the retirement of bonds through sinking funds from January 1, 1914, to April 30, 1914, and to provide cash for meeting certain sinking fund obligations.

The commission has rendered a decision in which it finds the present value of the operative property of the Ocean Shore Railroad Company as of June 30, 1912, to be $4,627,319.40.

The commission has rendered a decision dismissing the application of the Southern Counties Gas Company to issue $5000 bonds. An application of the same company, asking the commission to approve its action in depositing bonds of the par value of $15,000 for sinking fund purposes was also dismissed. The action taken in both cases was at the request of the gas company.

TRADE NOTES.

The Oro Electric Company will move its general offices from San Francisco to Stockton, Cal., August 1st.

Allis-Chalmers Manufacturing Company has been awarded an order for a 2000 kw. motor-generator set to be installed in the Jessie street plant of the Pacific Gas & Electric Company at San Francisco.

Chas. C. Moore & Company, Engineers, has secured through the Seattle office an order from the Alaska Treadwell Gold Mining Company for the installation of an additional 1200 kw. steam turbine unit to the present steam plant. The order was taken by H. W. Beecher, who recently returned from Juneau.

F. C. Perkins, of the Perkins Electric Company, has purchased the good will, shop and office equipment of the Reynolds Electric Company, at 310 First avenue South, Seattle, and will conduct the businesss in association with H. F. Reynolds. A large stock of new and used electrical machinery will be kept at Seattle, Vancouver and Portland.

The municipality of Seattle has awarded a contract for three 4700 k.v.a. oil insulated, water cooled transformers to the Allis-Chalmers Manufacturing Company of Milwaukee, Wisconsin. These transformers will be used to step up the 2500 volt 2-phase current from the 7500 kw. steam turbine unit recently purchased from Allis-Chalmers Manufacturing Company for 60,000 volt distribution in the city's transmission system. These transformers will be installed in the new steam auxiliary plant at Lake Union and will be delivered in September.

Some excellent reports have been received recently on the life of mercury rectifier bulbs used on constant current arc lighting circuits. These bulbs are guaranteed for an average life of 500 hours, but this guarantee is being generally exceeded, and in some instances an average life as high as from eight to fifteen times the guarantee has been obtained. The report of the Peoples Gas & Electric Company of Savanna, Illinois, recently issued, is an excellent example of what results are often obtained with a but slight attention on the part of the operators. This report showed an average bulb life for the last three years of 8398 hours. It should be noted that this life is not the individual life of bulbs but the average life, for some bulbs still in service, are operating in the neighborhood of 9000 hours. Mr. T. P. Bowen, manager of this plant, attributes this extra long average life to the fact that the bulbs are, as per instructions of the manufacturer, operated on short circuit for four or five minutes each night before throwing on the lamps. In addition to this treatment, the bulbs are occasionally taken from the tank and "rested" for a week or more and are also given an occasional hot water bath.

Confidence in the future of California oil resources has again been evidenced by the award in San Francisco of a large contract to Sanderson & Porter, the well known firm of engineers, for the entire installation of a pipe line for transporting oil from the great San Joaquin oil fields to tide water. The contract was consummated June 4th between Sanderson & Porter and the Valley Pipe Line Company. The latter is a $10,000,000 California company organized to handle this portion of the Shell-Royal Dutch Syndicate's California oil business. For the economic delivery of California oils through long pipe lines, it has become standard practice to heat the oil at each station, thereby reducing its viscosity and lowering the pumping pressure required. High thermal efficiency is secured by using the exhaust steam from high duty pumping engines at each station. Construction work on the pipe line is now being actively prosecuted, many surveys having been completed, and orders placed with the Youngstown Sheet & Tube Company of Youngstown, Ohio, for 175 miles of line-pipe, and with the Llewellyn Iron Works of Los Angeles, California, for the necessary equipment for station boilers of the Heine type.

CALIFORNIA ASSOCIATION OF ELECTRICAL INSPECTORS

Section of N. A. E. I.

C. W. Mitchell, President. Arthur Kempston.
Wm. G. Pennycook, Vice-Pres. B. C. Hill, Executive Comm.
John W. Carrell, Secretary-Treasurer, 55 Fulton, San Francisco.

The purpose of this organization is to standardize the common practice in electrical construction with the National Code as the general standard.

Questions pertaining to electrical construction will be answered in these columns, but only from the point of view of the Code. This is a voluntary organization and the answers published under this heading must not be construed as authoritative, or binding. No attempt will be made to correllate the answer from the several Inspection Districts, as an occasional difference of opinion will tend to induce further study on subjects. All questions will be passed upon by an executive committee.

Address all communications to the secretary.

Grounding the Neutral of Low Voltage Systems.

BY THE SECRETARY.

Grounding the neutral wire of 3-wire systems will (1) prevent a break in the neutral wire of the street service, causing higher than the normal voltage to enter some of the circuits due to unbalancing; (2) will minimize the life and insulation hazards due to sneak currents; (3) will, if the ground connection is made within the building and includes all complete metallic underground piping systems, prevent the hazard due to stray street railway currents.

The breaking of a neutral of the street service is an accident which occurs more often than is generally supposed. When this occurs the lamps of some of the circuits will glow with exceeding brilliancy while those of other circuits will glow correspondingly dim. In extreme cases lamps may be burned out and wires heated. Grounding the neutral wire at the generator or transformer and at intervals on the line will cause the unbalanced current to return through the ground.

The origin of the sneak current is subject to much difference of opinion. Damage is effected which in the opinion of experts could not be accomplished by the normal voltage of the circuit; but when a test is made normal conditions prevail. The probable cause is leakage from the primary to the secondary coils of the transformer coincident with leakage on one of the primary wires which may be momentary; this condition may cause a current of small volume but of high pressure to seek a passage to the ground over the wires of the secondary circuit. The high pressure small volume current creates a path which the current of the low voltage system will follow. This condition is especially destructive to the insulation of motor windings and is the probable cause of many deaths, grounding the secondary system will provide a free passage to the ground for the sneak current.

Street railway currents travel from the generator over the trolley wire, through the mechanism of the car to the rails and are supposed to return over the rails and through the earth to the generator; but much of this return current jumps to adjacent underground piping which may run parallel with the track. Leads from such piping systems may cause stray currents to enter buildings at a potential somewhat higher than the surrounding earth and return through other piping systems; may arc to other piping system to which it is in contact but not electrically bonded. The grounding of the neutral within buildings to all available underground piping will also provide a bond which will eliminate the stray current hazard so far as the building is concerned.

To protect a building and its occupants from fire and life hazards by precautions taken within the building seems desirable. To ground the neutral at the point where it leaves the service conduit and before it enters the service switch seems to be the most logical method as a ground connection at that point will give the most complete protection against unbalancing and from sneak currents, as well as eliminate the aforesaid stray current hazard. A very reasonable objection to grounding the neutral of underground systems at each distribution box through the box is set forth by power companies because the grounded neutral offers a path for the return street railway currents which will cause a drop of potential in the three-wire circuit while heavy traffic passes certain points, a source of much annoyance.

The above statements are based upon the assumption that neutrals are grounded at the generators and transformers.

Rule 15 N. E. Code, gives complete data on methods for ground connections.

RULING ON NITROGEN FILLED LAMPS.

James M. Barry, chief of the department of electricity of San Francisco, has approved the installation of the new 750 watt and 1000 watt nitrogen filled lamps when installed in accordance with the provisions of Paragraph 2, Section 23-d, of the National Electrical Code, which reads as follows:

By special permission, in cases where wiring equal in size and insulation to No. 14 B. & S. gage approved rubber-covered wire is carried direct into keyless sockets or receptacles, and where the location of sockets and receptacles is such as to render unlikely the attachment of flexible cords thereto, the circuits may be so arranged that not more than 1320 watts (or thirty-two sockets or receptacles) will be dependent upon the final cutout.

ELECTRICAL CONTRACTORS' NOTES.

The National Ice & Storage Company at East Water and Washington streets, Portland, Oregon, have awarded the electrical contract in their building to B. E. Davies.

The electrical contract for the three-story apartment house of A. C. Bernitt has been awarded the Groud Electric Company of Portland.

The electric fixtures for the Piedmont Presbyterian church, three story concrete, located at Cleveland avenue and Jarrett streets, Portland, have been awarded to the J. C. English Company, also the Westminster Presbyterian Church, east Sixteenth and Schuyler streets.

The electrical work in the two story brick garage, located at east Third and Oregon streets and owned by F. Kiernay, has been awarded to the NePage, McKenny Company of Portland.

The Tuerck-MacKenzie Company has the contract for the electrical work in the Clifford hotel, located at east Sixth and Morrison streets, Portland.

Oregon Electrical Ordinances.

	Date passed	License fee on bond for Contractor	Permit fee	Ordinance requires conduit in fire limits	Inspection charges	Inspectors
Ashland	1/21/13	No	No	No	No	H. G. Butterfield
Albany		Yes	Yes	No	No	Griff King
Astoria	5/13/13	No	No	No	No	C. E. Foster
Baker	3/27/14	$20.00	50c	Yes	No	F. H. Grabner
Dallas	1/16/13	No	No	No	No	E. J. Himes
Eugene	8/12/13	No	Yes*	No	Yes†	W. H. Alexander
Grants Pass	1/24/13	No	Yes	No	No	C. E. McLane
Hillsboro	2/ 4/13	No	No	No	No	J. H. Hensley
Independence						H. A. Bottomly
Klamath Falls	9/22/09	No	No	No	Yes*	C. E. Meldrum
La Grande	6/ 3/14	$20.00	50c	Yes	No	W. A. Benham
Medford	1/21/13	$10.00	No	No	No	L. E. Hinman
Marshfield	8/10/09 7/ 1/13 amended	$25.00	50c *	No	†	C. W. Tribbey
Pendleton	5/20/14	No	No		No	Cliff Bellinger
Portland	6/24/10	$500 bond	O	O	O	E. F. Dunlap
Roseburg	4/22/12	$500 $510	O	O	O	H.W.Worthington
Salem	4/ 7/13	No	No	No	No	P. McCrackan
Sheridan	1/14/13	No	No	No	No	E. N. McGann
The Dalles	5/21/14	No	No	No	No	Roy Marshall

Note:—*A graduated scale.
†A special charge made for extra inspections.

NEWS NOTES

ILLUMINATION.

AUMSVILLE, ORE.—The town authorities have granted a lighting franchise to the Aumsville Flour Mills.

WHEELER, ORE.—Wheeler is to put in its own electric light system, power being furnished from the water system.

NEWPORT. ORE.—The Yaquine Electric Company, Newport, Oregon, began the operation of its Toledo plant early in June.

CHEHALIS, WASH.—B. F. Walling wants a new light and power franchise in Chehalis. There is some objection to a 50 year franchise.

SEATTLE, WASH.—Bills have been passed for the appropriation of $125,000 to complete the first unit of the auxiliary steam plant now under construction.

NOGALES, ARIZ.—Spiro S. Proto and Monte M. Mansfield, who were granted an electric light franchise here recently, are arranging to begin installation in a short time.

EUGENE, ORE.—The Oregon Power Company is engaged in a power war with the municipal lighting plant. The city has entered complaint alleging bonuses, rebates, etc.

VALLEJO, CAL.—The city council has awarded the contract for 40 electroliers to be installed on Virginia street, to the Pacific Fire Extinguisher Company at the price named in their bid, $4920.

LOS ANGELES, CAL.—Bids will be received by the board of supervisors of Los Angeles county up to July 20th for furnishing electricity and maintaining lights in Green Meadows Lighting District No. 1.

WENATCHEE, WASH.—The Wenatchee Valley Gas & Electric Company, Wenatchee, Washington, has announced a reduction, amounting to about 30 per cent in the residential and commercial use of electricity.

AUBURN, WASH.—The Auburn Gas Company has had engineers at work the past few days surveying to lay pipe and a plan of this will be filed with the council for approval. The company is capitalized for $50,000.

SEATTLE, WASH.—The city council has passed an ordinance appropriating $125,000 from the light fund to complete the first unit of the steam plant. The supreme court has decided in favor of the validity of the bonds for $425,000 for the construction of the auxiliary steam power plant on Lake Union.

ANCON, CANAL ZONE.—The electric light and power plant at Empire was shut down July 1, and hereafter, current for light and power will be supplied the towns on the west side of the canal from the Miraflores steam plant. In using current from the Miraflores plant, the existing overhead lines were connected to the submarine cable which crosses the canal at Cucaracha for the operation of the relay pumps on the west bank of the Cut in connection with the work of dredging. Some of the transformers were changed on account of the change in frequency from 60 to 25 cycles.

SACRAMENTO, CAL.—The state board of control and Superintendent of Capitol Buildings and Grounds George Radcliff won their fight for the retention of the old lighting rate for the capitol when the bids were opened last week. Previous bids refused by the board raised the old rate from 1⅞c per kilowatt-hour to 3 cents. The bid of the Pacific Gas & Electric Company was 2½ cents for power and 3c for light. The bid of the Great Western Power Company, holder of the present contract, calls for the continuance of the present service without a formal contract under the old price of 1⅞c until an indefinite time in the future, when it is suggested the matter may be taken before the railroad commission for an adjustment.

LOS ANGELES, CAL.—Relative to what course his office will pursue in handling the gas rate question in court and in order that the public may have an understanding of the entire situation, not only as to his ideas, but as to the law, City Attorney Stephens has issued the following statement, showing that the real fight will occur if the Los Angeles Gas & Electric Corporation contests the 40c natural gas rate fixed for the ensuing fiscal year. "If a temporary order should be granted in the Los Angeles Gas Company's case the court would probably request that a temporary rate be agreed upon, the difference between such agreed rate and 40c would be impounded until final determination of the matter. Any such temporary rate would be suggested by the council. The court could, and might in this case instead of impounding the difference, require the filing of an indemnity bond. My policy in the gas question is and will be as follows: Exert every effort to get natural gas distributed, and much as possible—first to domestic consumers, then for industrial consumption. Resist every attack on the legal rate as fixed by the council revaluing the company's investments and cost of distribution, and I am highly pleased that Mr. Mulholland will undertake the task of superintending such a revaluation."

TRANSMISSION.

WHITE SALMON, WASH.—The Northwestern Electric Company will shortly start the construction of another power house on White Salmon River, 12 miles from White Salmon.

LEWISTON, IDAHO.—The Lewiston-Clarkston Improvement Company has inaugurated construction on the extension of its power lines to Lapwai. The line will be completed by September 1st.

JEROME, ARIZ.—An ordinance has been adopted by the common council granting a franchise to the Upper Verde Public Utilities Company, to purchase and operate an electric lighting and power system, heating and cold storage system, telephone-telegraph system, gas plant and system, water system and sewer system.

EUGENE, ORE.—With surveys and preliminary work on the power project of the Oregon Electric Clear Lake completed, negotiations are under way for the necessary power rights, and the railroad expects permission within 90 days to go ahead with construction upon two plants to produce 90,000 h.p. for distribution all over Oregon.

OROVILLE, CAL.—The Great Western Power Company has placed a larger force of men at work on its project in Big Meadows. The head dam across the Feather River is to be raised ten feet this summer. The dam is now 65 ft. high. This addition to the dam is needed because of the new units being added to the power plant at Big Bend just above Oroville on the Feather River.

EUGENE, ORE.—Water rights to be granted by the state and by the United States government to make possible actual construction on the $5,000,000 power project of the Oregon Electric at Clear Lake, 75 miles east of Eugene, are expected within 90 days, according to L. C. Gilman, president of the electric road, who was in Eugene today. Surveys and preliminary work have been completed and the final negotiations for permission to start work are now under way. The project includes the construction of a canal from the lake, which is on the summit of the Cascades, and two power plants, which, combined, will generate 90,000 possible horsepower. The final estimates of the engineers, with tests and measurements taken during a period of three years, were completed this spring and are said to have been accepted.

SACRAMENTO, CAL.—Water power projects which will Water Commission, and now holds permits to operate, according to a report covering the first two years of its existence. The largest of the projects now holding permits is that of the Yolo Water & Power Company on Clear Lake and Cache Creek, which will cost $5,185,000, and is to develop 49,000 h.p. The other holders of permits for projects now in course of development are one of 1000 h.p. on Boulder Creek; Salva Olsen, $7500, 100 h.p., north fork of Feather River; J. F. Thompson, $4000, 100 h.p. Volcano Canyon; C. E. Loose, $422,301.90, 10,420 h.p., East Walker, Birchville Mining Company, $30,000 300 h.p. Weaver Lake; R. G. Gillespie, $18,500, 200 h.p. North Yuba River. Three of these projects must be completed during 1914, one in 1915, two in 1916, and one—that of the Yolo Water & Power Company—in 1919, in accordance with the time limits fixed in the permits.

TRANSPORTATION.

DIXON, CAL.——The Sacramento Valley Electric Road has been refused permission to run its tracks on First street, the principal business thoroughfare of this city.

WALLACE, IDAHO.—The Interstate Callahan mine is contemplating the construction of an aerial tramway to connect it with a 9 mile branch of the N. P. Road, 2 miles.

ASTORIA, ORE.—The council has granted modified franchise asked for by the Pacific Power & Light Company for proposed extensions in the east and west ends of the city.

LOS ANGELES, CAL.—A franchise for the construction of an elevated railway from the rear of the Pacific Electric station at Sixth and Main streets to San Pedro street, has been ordered sold to the Pacific Electric Company by the city council.

SAN FRANCISCO, CAL.—President Jesse W. Lilienthal of the United Railroads has expressed his willingness to enter into negotiations with the city for the sale of the United Railroads on the plan proposed by the public utilities committee of the supervisors.

SAN DIEGO, CAL.—Sealed bids will be received up to July 27th, by the common council of San Diego, for a franchise granting the right to construct a general commercial railroad along certain streets and places in San Diego, for a period ending December, 1952. The franchise has been applied for by the Bay Shore Railway Company.

TUCSON, ARIZ.—Arrangements have been concluded between the Tucson Street Railway Company and owners of property beyond University avenue for the extension of street car service from the present terminus on University north on Park avenue to Speedway, and east on Speedway, The extension, together with equipment, will cost about $25,000.

OAKLAND, CAL.—The contract for the superstructure of the new class C headquarters of the San Francisco-Oakland Terminal Railways at Twenty-second street and San Pablo avenue, has been awarded to Baccus & Kennedy for a figure slightly in excess of $20,000. This firm has placed the foundations of the building and will start work on its new contract immediately.

SAN FRANCISCO, CAL.—Negotiations that have been pending with the O'Neill estate over the purchase of a part of a block of land for the municipal street railway car barn at Seventeenth and Hampshire streets, were concluded a few days ago by City Attorney Long for $44,750. The estate claimed the land was worth $55,000 and the city ordered the land condemned. The city attorney held it was better to pay $44,750 than wait the delay of condemnation proceedings.

SAN FRANCISCO, CAL.—The Geary Street Railroad earned $136,430.20 for the fiscal year ending June 30. The earnings of the Union Street Road are estimated at $53,000, this line having been taken over by the city in December. The gross receipts of the Geary street line for the year were $641,374.48, and those of the Union street line for the seven months under municipal management, $189,535.37. No allowance is made in the statement of the Geary and Union street lines, as given out, either for depreciation or for the taxes which would have been paid had the roads been under private management. The statement of the Geary street line earnings is:

Gross receipts		$641,374.48
Expenses—		
Operating	$297,025.14	
Sinking fund	115,447.41	
Interest on bonds	88,605.55	
Liability insurance	3,866.18	504,944.28
Net earnings		$136,430.20

TELEPHONE AND TELEGRAPH.

FLORENCE, ORE.—The Suislaw Home Telephone Company has made arrangements to build a line from Florence to Heceta lighthouse.

EUGENE, ORE.—The county court has granted a franchise to the Suislaw Home Telephone Company to operate a telephone line over the county roads in lower Suislaw around Florence.

NOGALES, ARIZ.—Improvements are under way at Nogales, which when completed, will give the city a complete new telphone system. New equipment, poles, cables, switchboards, etc., are being installed.

HELENA, MONT.—The Helena Automatic Telephone Company discontinued service on July 1st. The action of local business men in taking out their phones has reduced the number of subscribers below a profitable basis.

CHEHALIS, WASH.—The Evergreen Telephone Company has applied to the county commissioners for a franchise northeast of Centralia. The Klickitat Telephone Company has applied for a franchise to operate through Glenoma, Nesika, Kosmos and Riffe and Mossyrock in East Lewis county. The hearing is set for July 7th.

WATERWORKS.

ZILLAH, WASH.—Negotiations are pending between the Zillah waterworks and the town regarding the proposed sale of the plant. The system is owned by Walter N. Granger Jr. and is offered for $12,000.

SAN BERNARDINO, CAL.—Immediate construction of a filter to purify Lytle creek water before it enters the reservoir, is now planned by the water commission, and Superintendent Harris is working on the project.

CHEHALIS, WASH..—T. C. Rush and the city commission have worked out a plan for the purchase of the water system. The city agrees to pay Mr. Rush $30,000 for his holdings in the plant, $11,000 in bonds and $19,000 out of the revenues.

SPOKANE, WASH.—Commissioner of Public Utilities C. M. Fassett is contemplating improvements at the up river pumping plant in the way of an auxiliary water station with pumps to be driven by water power that will cost from $100,000 to $125,000.

GLENDALE, ARIZ.—An election will be held July 21st to vote on bonds in the sum of $248,000 for the purchase of four water plants supplying water to the city. Of this sum $159,000 will be used to purchase the systems and the remainder for extensions.

PORTLAND, ORE.—Preliminary work on the construction of the dam to raise the intake at the headworks of the Bull Run pipe line which has long been contemplated, will begin this summer. The dam will be of reinforced concrete and will cost approximately $100,000.

SAN DIEGO, CAL.—Edwin Duryea, Jr., special hydraulic engineer, retained by the water commission, has filed his report recommending the spending of $470,000 of the recent water bond issue. Two big items recommended by him are the Dulzura conduit, to cost $185,000, and the development of a complete pumping plant in San Diego River at a cost of $200,000. Lesser items include improvements and repairs to the Dulzura conduit, $30,000; pumping plant to save Otay seepage, $5000; and $50,000 for engineering investigation.

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C-2 Colonial Lamp Works.....
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